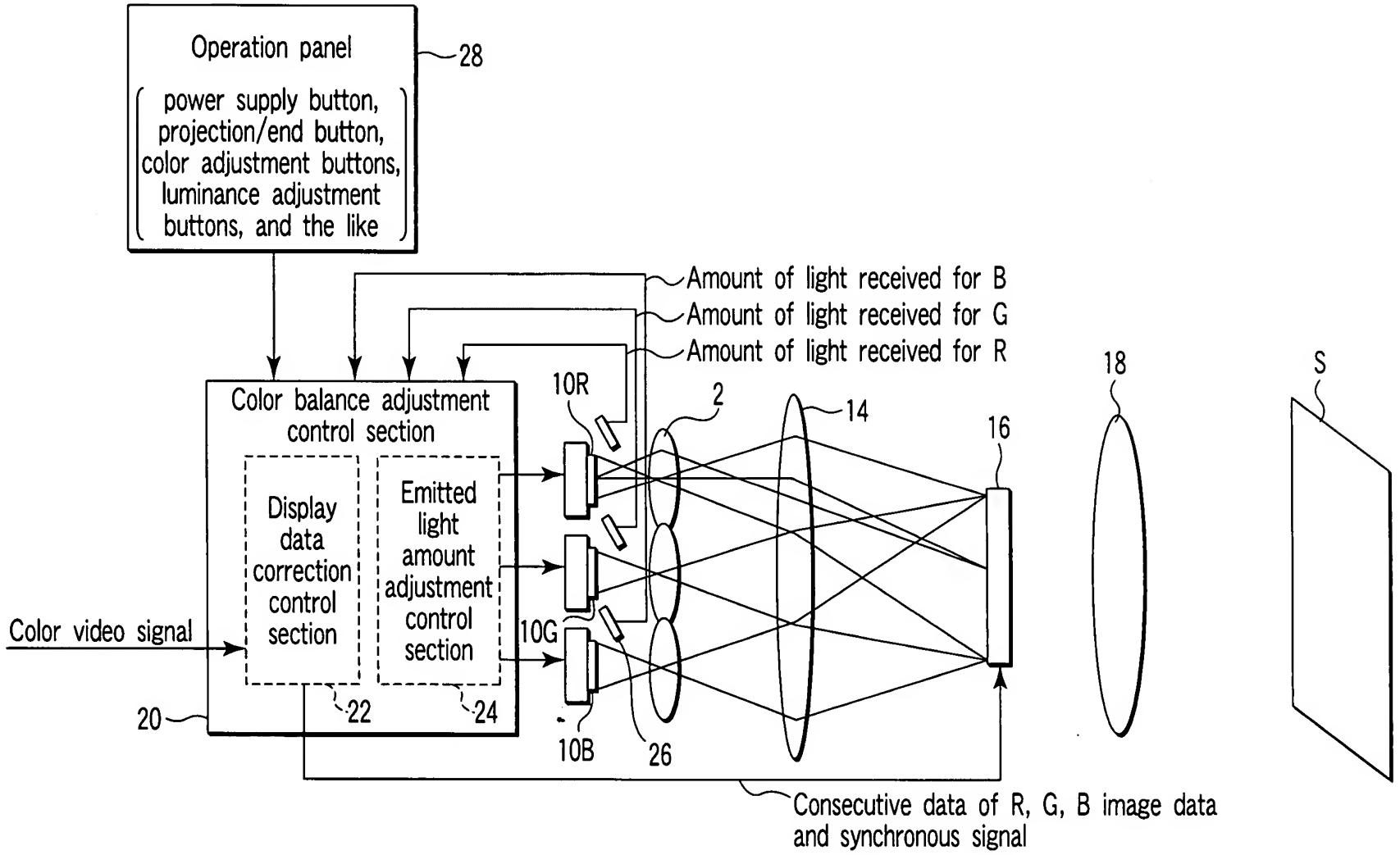

Operation panel
power supply button, projection/end button, color adjustment buttons, luminance adjustment buttons, and the like
28
Amount of light received for B
Amount of light received for G
Amount of light received for R
Color balance adjustment control section
Display data correction control section
Emitted light amount adjustment control section
22
24
20
Color video signal
10R
10G
10B
2
26
14
16
18
S
Consecutive data of R, G, B image data and synchronous signal

FIG. 1

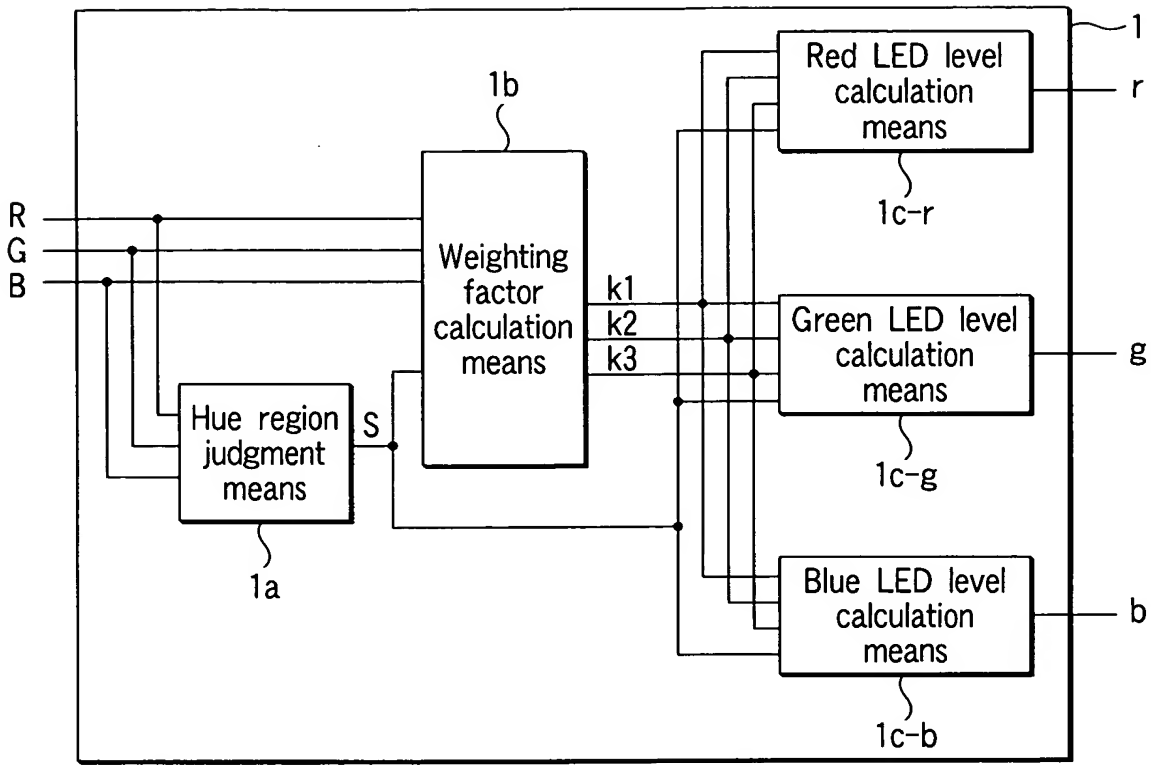


FIG. 2 PRIOR ART

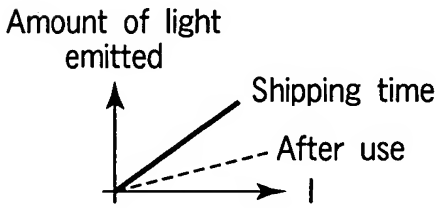


FIG. 3

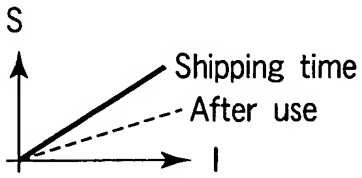


FIG. 4

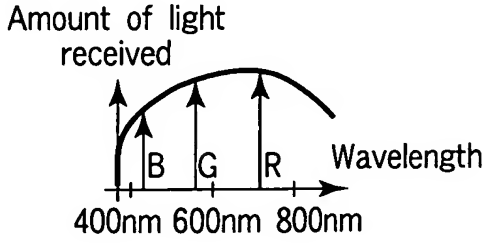


FIG. 5

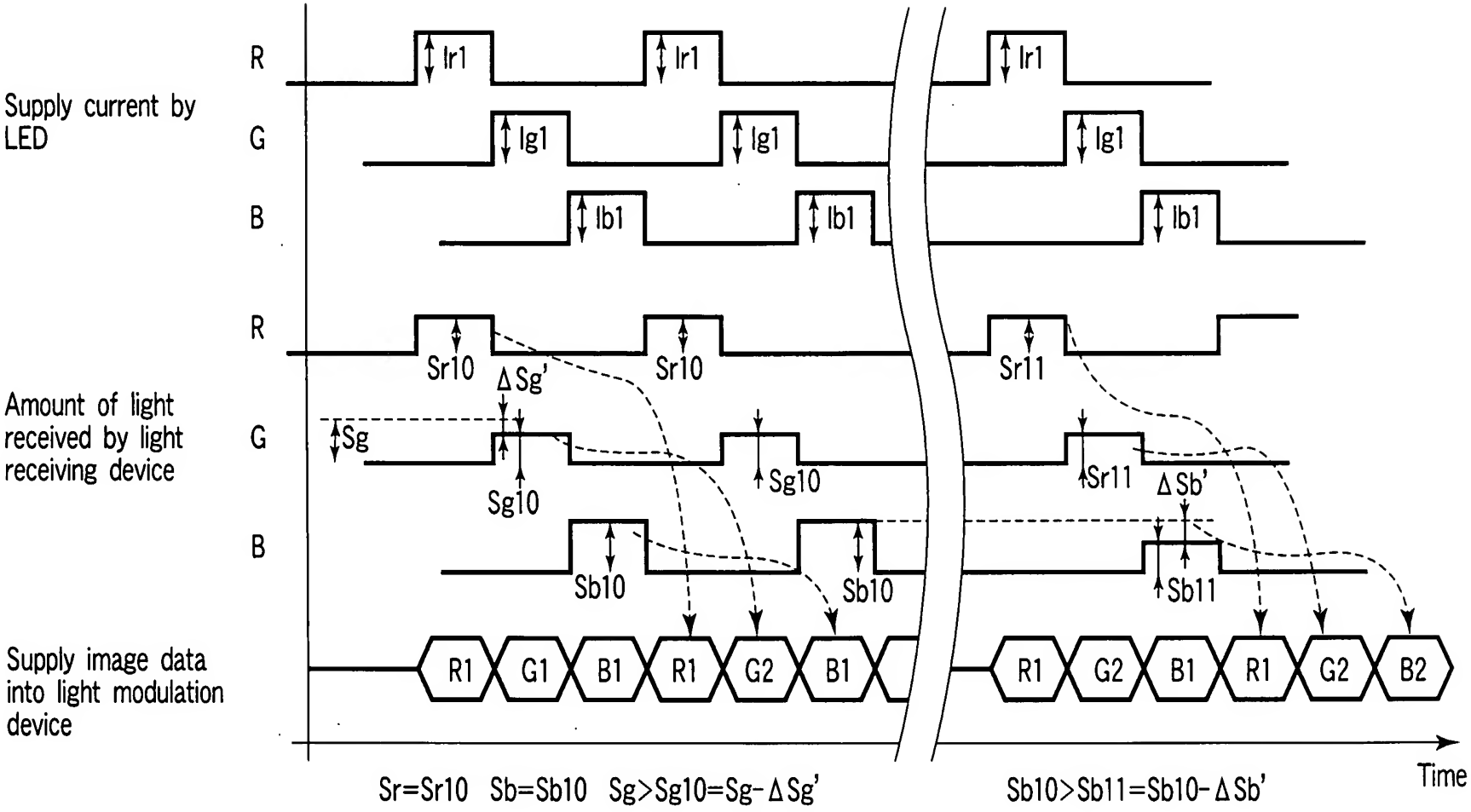
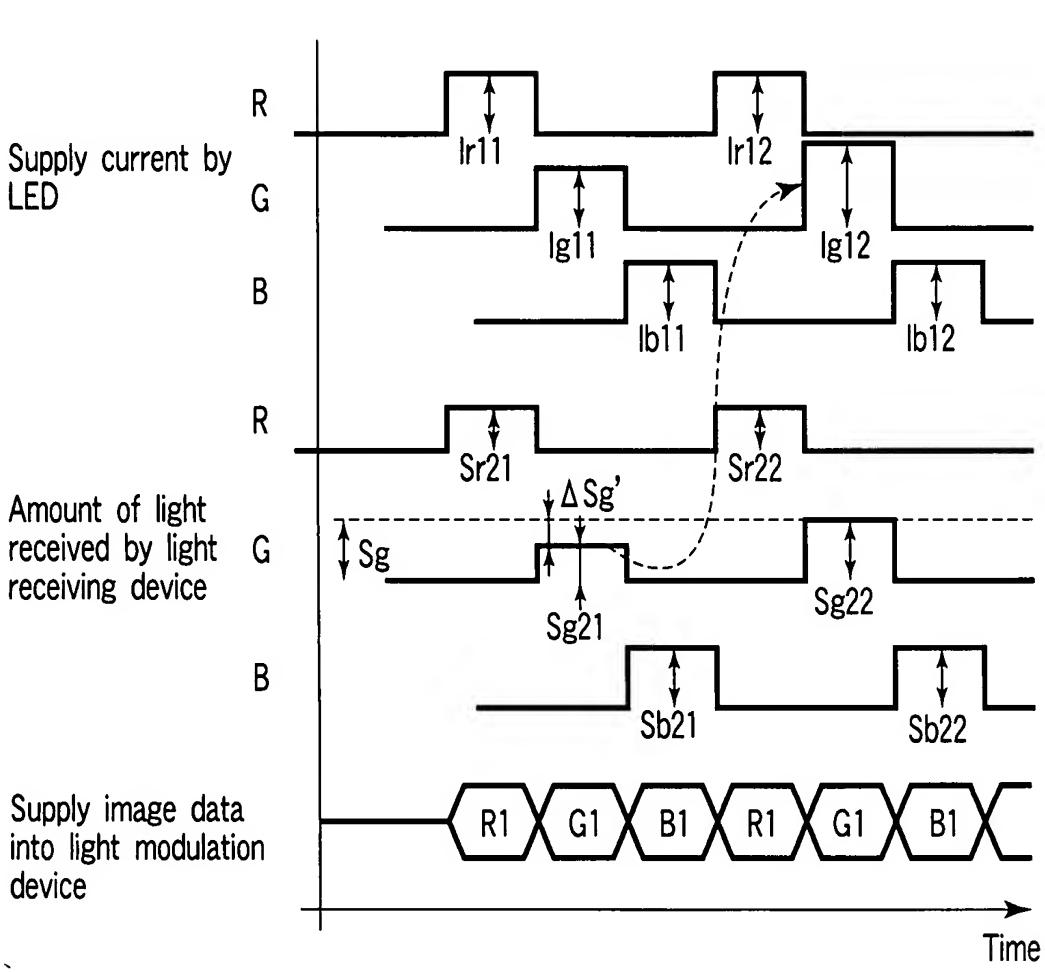
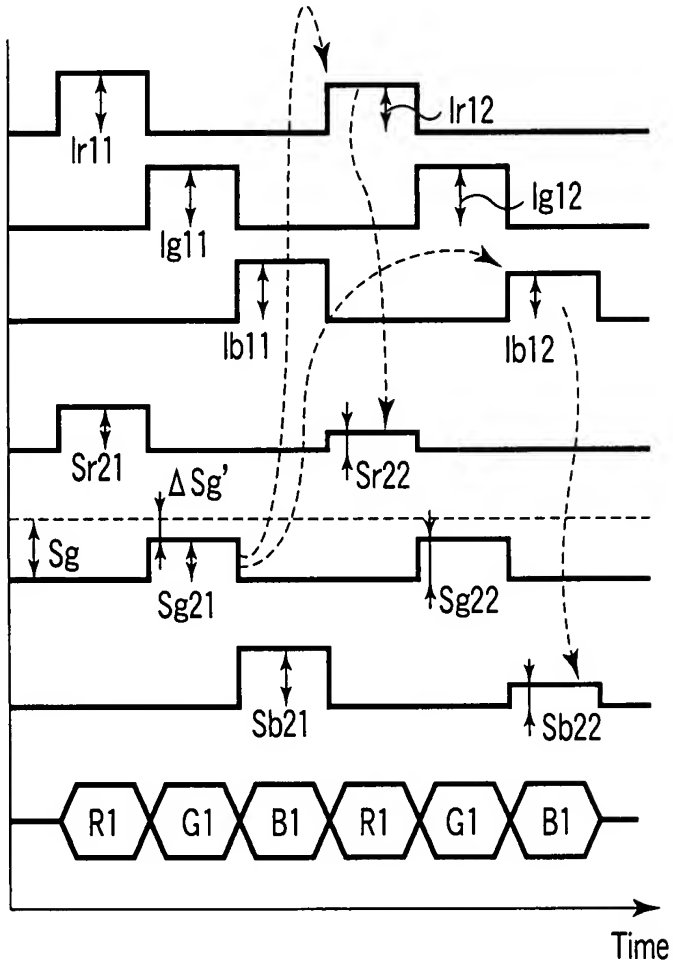

Supply current by LED
R
G
B
Ir1
Ig1
Ib1
Amount of light received by light receiving device
R
G
B
Sr10
ΔSg'
Sg
Sg10
Sb10
Sr11
ΔSb'
Sb11
Supply image data into light modulation device
R1
G1
B1
R1
G2
B1
R1
G2
B1
R1
G2
B2
Time
Sr=Sr10 Sb=Sb10 Sg>Sg10=Sg-ΔSg'
Sb10>Sb11=Sb10-ΔSb'

FIG. 6



Sr=Sr21 Sb=Sb21 Sg>Sg21=Sg-ΔSg'

FIG. 7



Sg>Sg21=Sg-ΔSg' Sr=Sr21 Sb=Sb21

FIG. 8

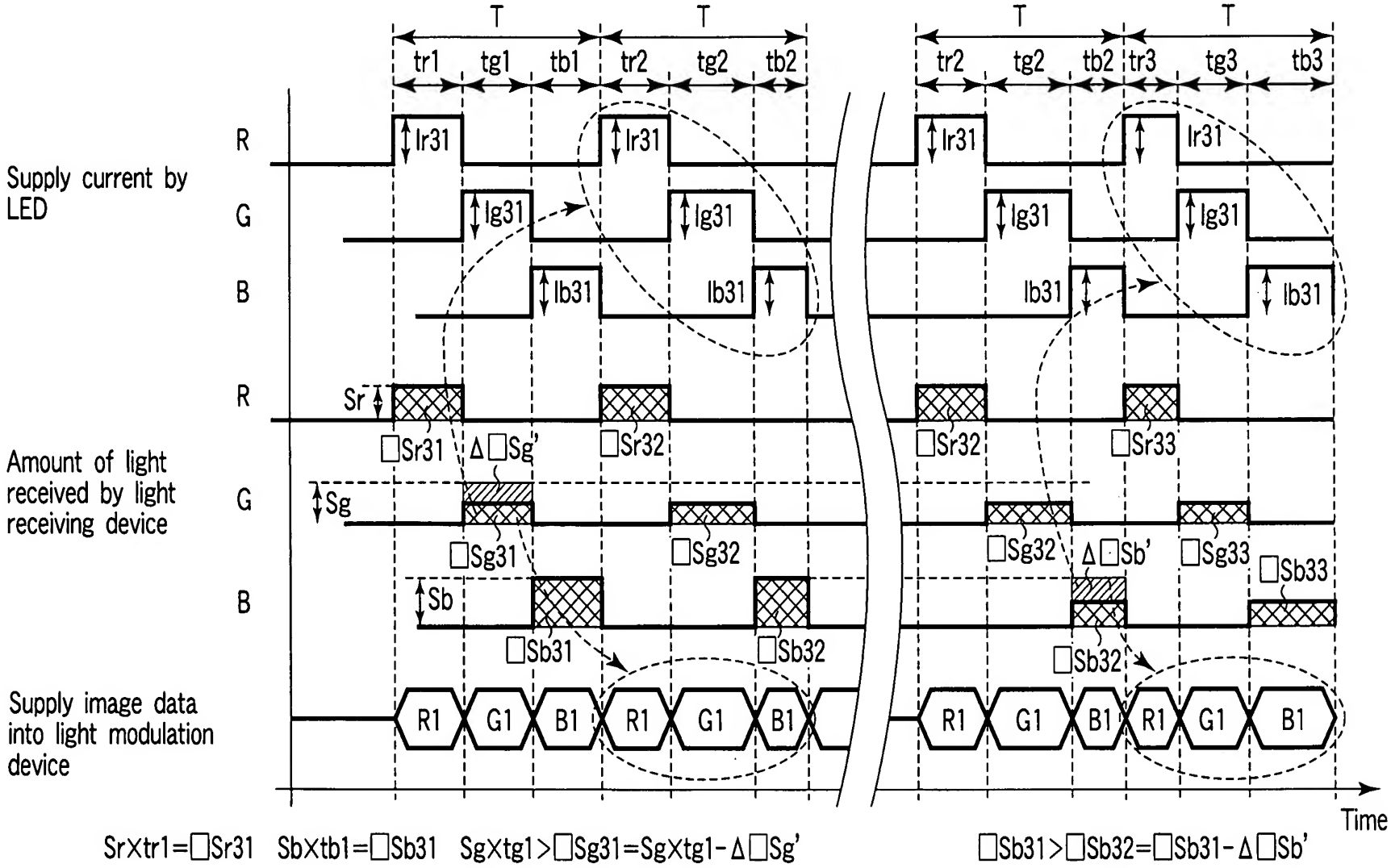

T
T
T
T
tr1
tg1
tb1
tr2
tg2
tb2
tr2
tg2
tb2
tr3
tg3
tb3
Supply current by LED
R
G
B
Ir31
Ig31
Ib31
Amount of light received by light receiving device
R
G
B
Sr
Sg
Sb
□Sr31
Δ□Sg'
□Sg31
□Sb31
□Sr32
□Sg32
□Sb32
□Sr32
□Sr33
□Sg32
Δ□Sb'
□Sg33
□Sb33
□Sb32
Supply image data into light modulation device
R1
G1
B1
Time
Sr×tr1=□Sr31
Sb×tb1=□Sb31
Sg×tg1>□Sg31=Sg×tg1-Δ□Sg'
□Sb31>□Sb32=□Sb31-Δ□Sb'

FIG. 9

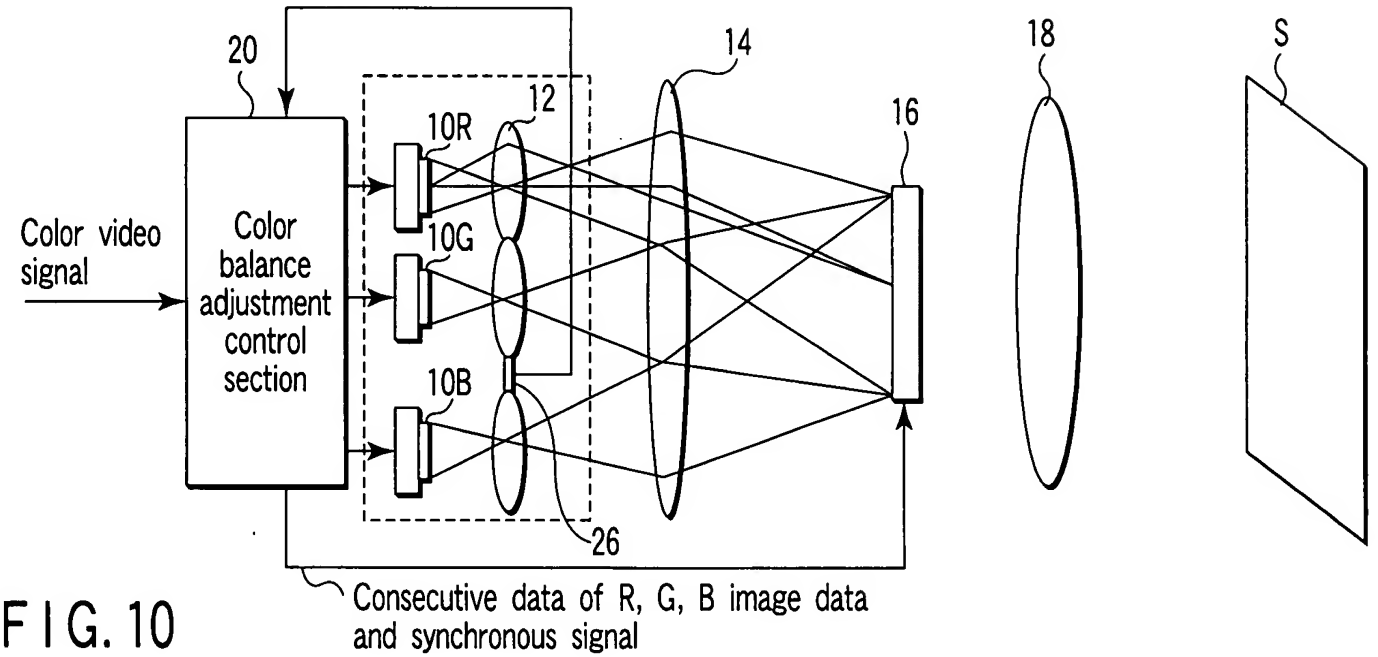

20
14
18
S
12
10R
16
Color video signal
Color balance adjustment control section
10G
10B
26
Consecutive data of R, G, B image data and synchronous signal

FIG. 10

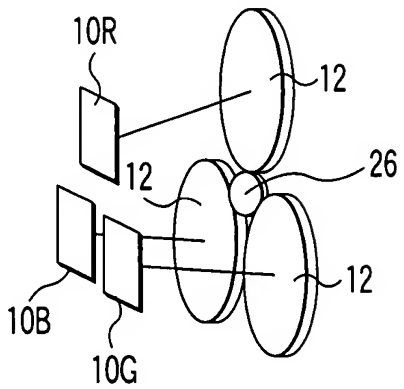

10R
12
12
26
12
10B
10G

FIG. 11

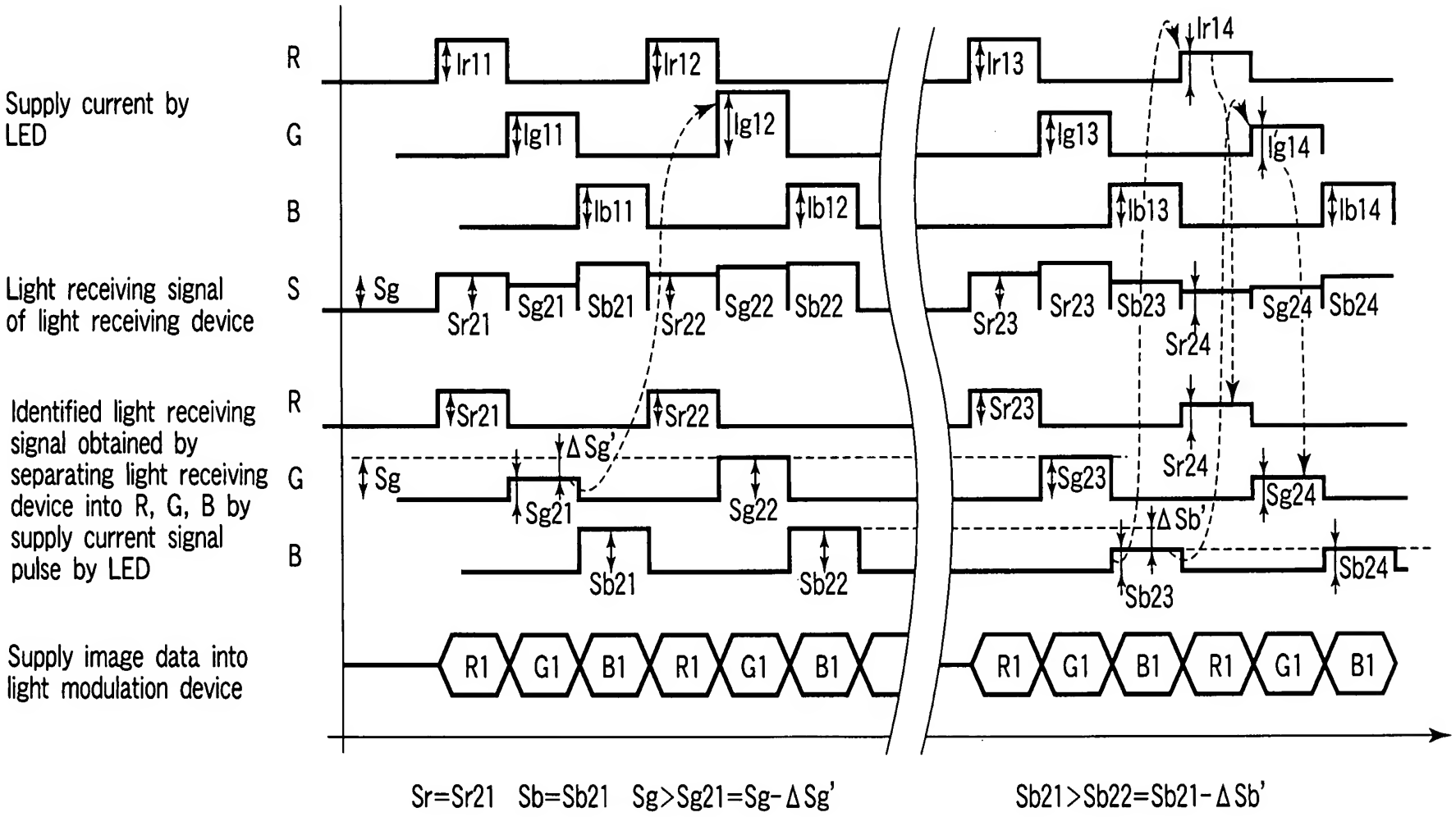

Supply current by LED
Light receiving signal of light receiving device
Identified light receiving signal obtained by separating light receiving device into R, G, B by supply current signal pulse by LED
Supply image data into light modulation device
R
G
B
S
Ir11
Ir12
Ir13
Ir14
Ig11
Ig12
Ig13
Ig14
Ib11
Ib12
Ib13
Ib14
Sg
Sr21
Sg21
Sb21
Sr22
Sg22
Sb22
Sr23
Sb23
Sr24
Sg24
Sb24
ΔSg'
ΔSb'
R1
G1
B1
Sr=Sr21 Sb=Sb21 Sg>Sg21=Sg-ΔSg'
Sb21>Sb22=Sb21-ΔSb'

FIG. 12

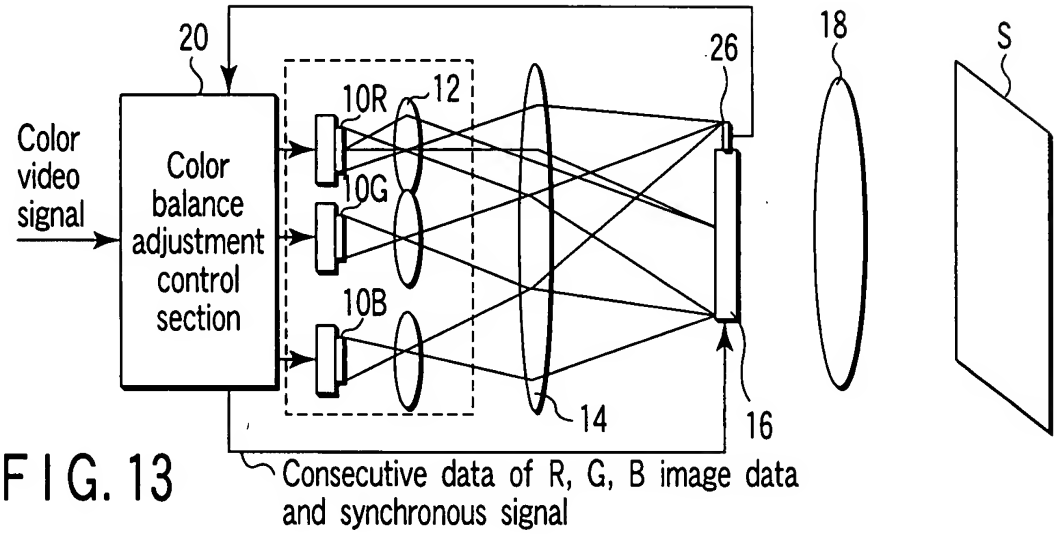


FIG. 13

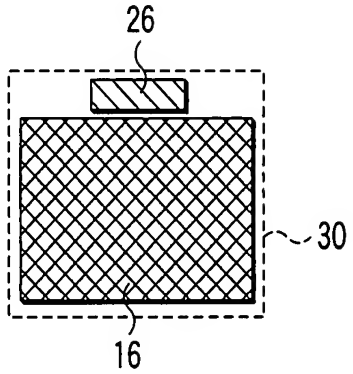


FIG. 14

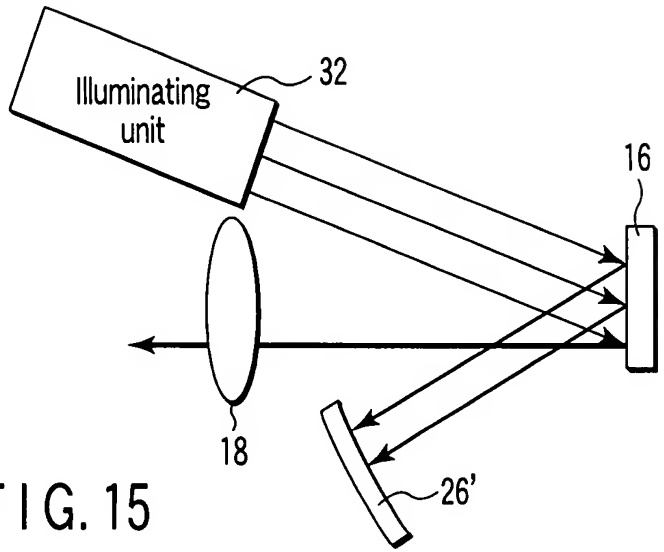


FIG. 15

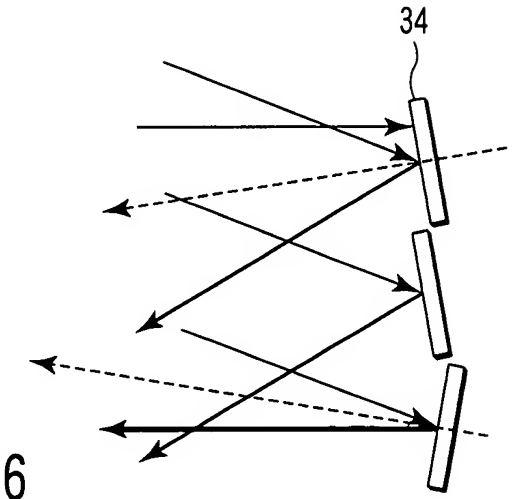


FIG. 16

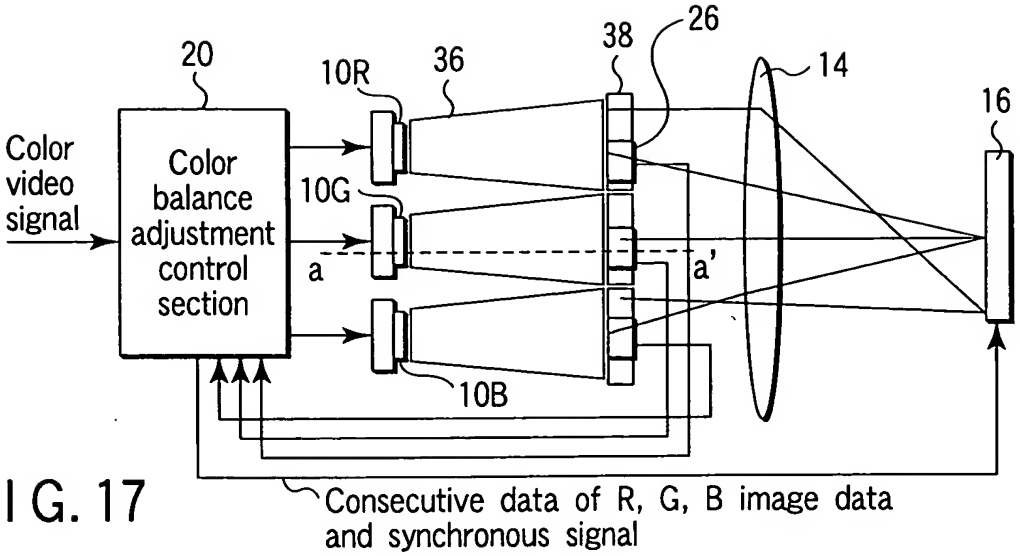


FIG. 17

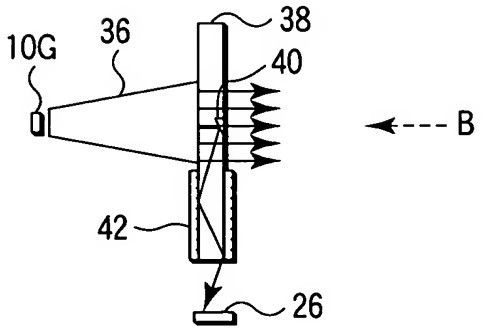


FIG. 18

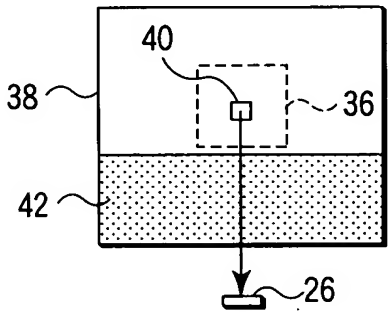


FIG. 19

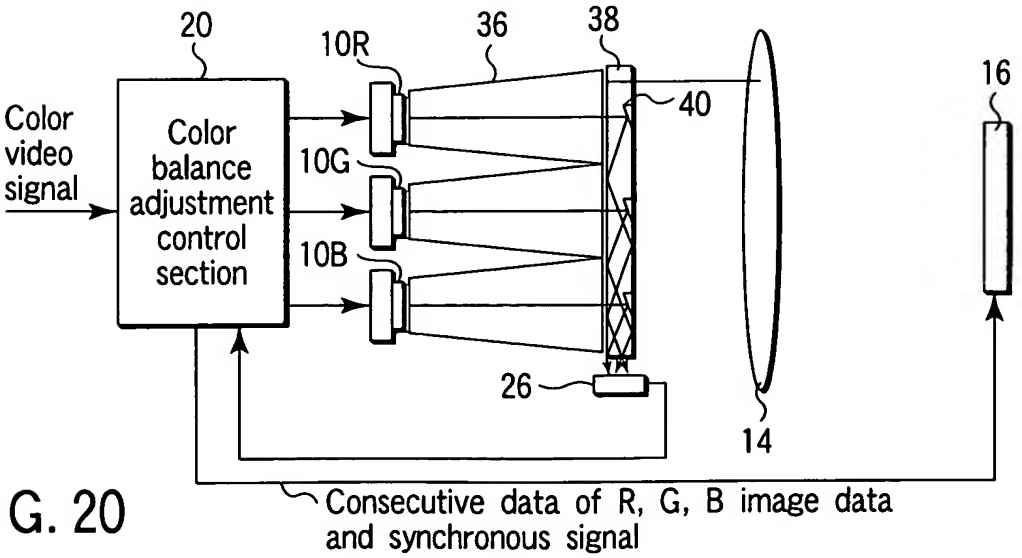


FIG. 20

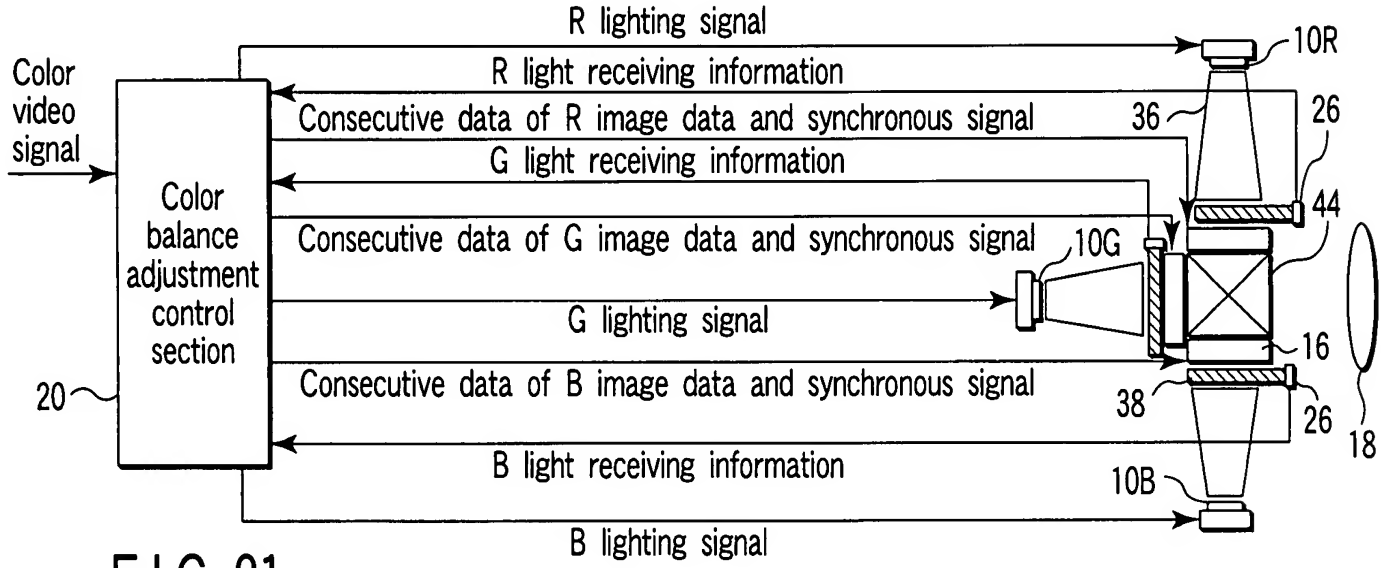

R lighting signal
R light receiving information
Consecutive data of R image data and synchronous signal
G light receiving information
Consecutive data of G image data and synchronous signal
G lighting signal
Consecutive data of B image data and synchronous signal
B light receiving information
B lighting signal
Color video signal
Color balance adjustment control section
20
10R
10G
10B
36
26
44
16
38
18

FIG. 21

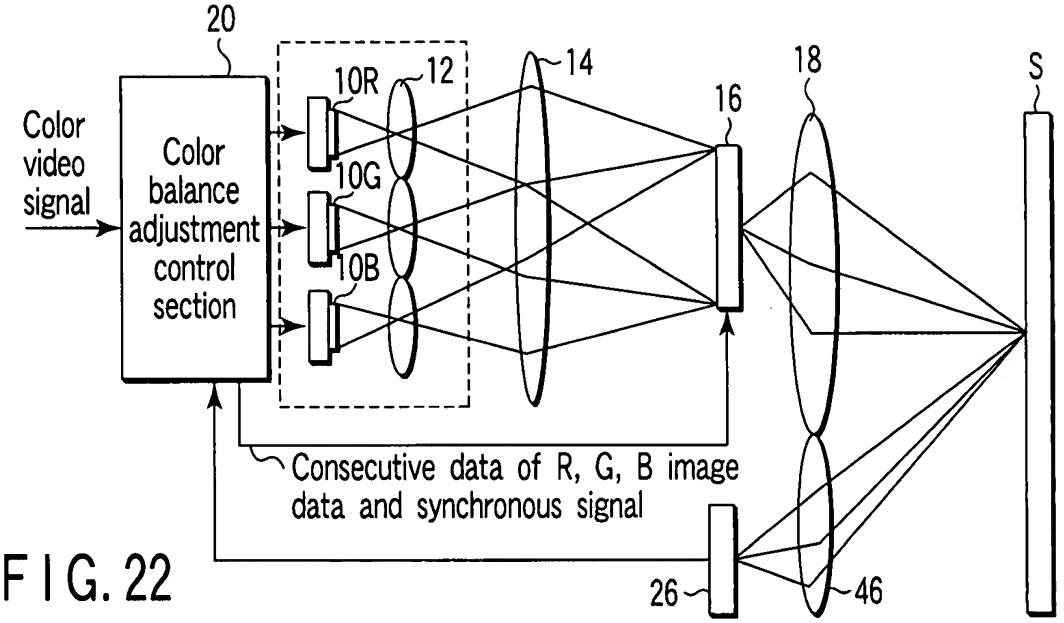

20
Color video signal
Color balance adjustment control section
10R
10G
10B
12
14
16
18
S
Consecutive data of R, G, B image data and synchronous signal
26
46

FIG. 22

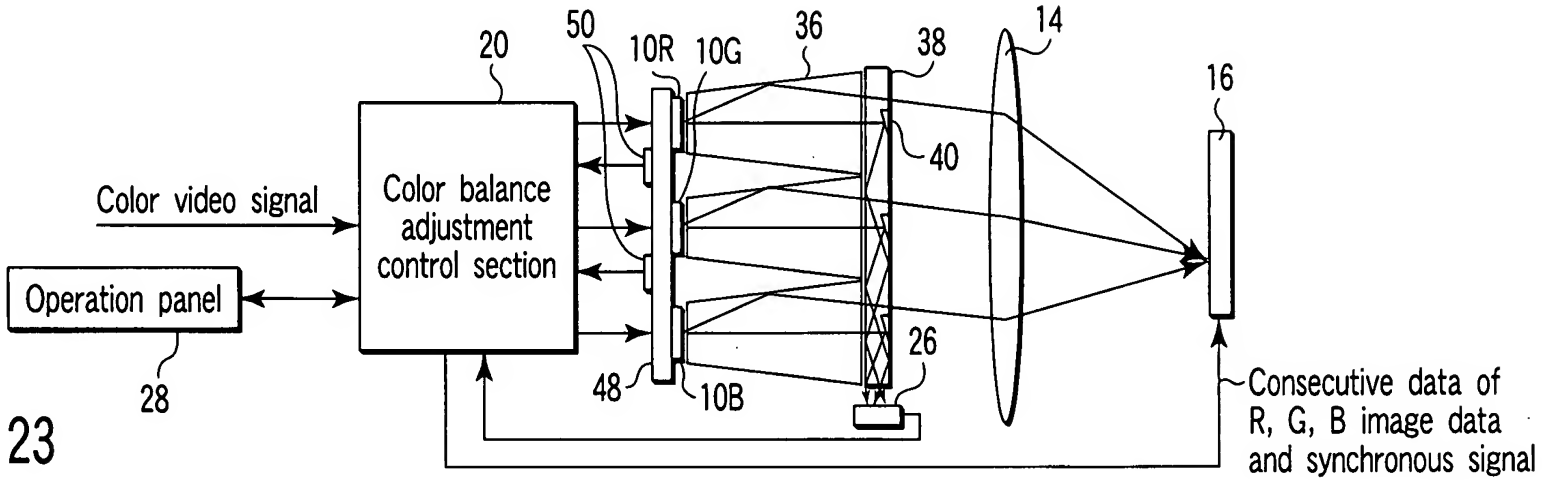

20
50
10R
10G
36
38
14
16
40
Color video signal
Color balance adjustment control section
Operation panel
28
48
10B
26
Consecutive data of R, G, B image data and synchronous signal

FIG. 23

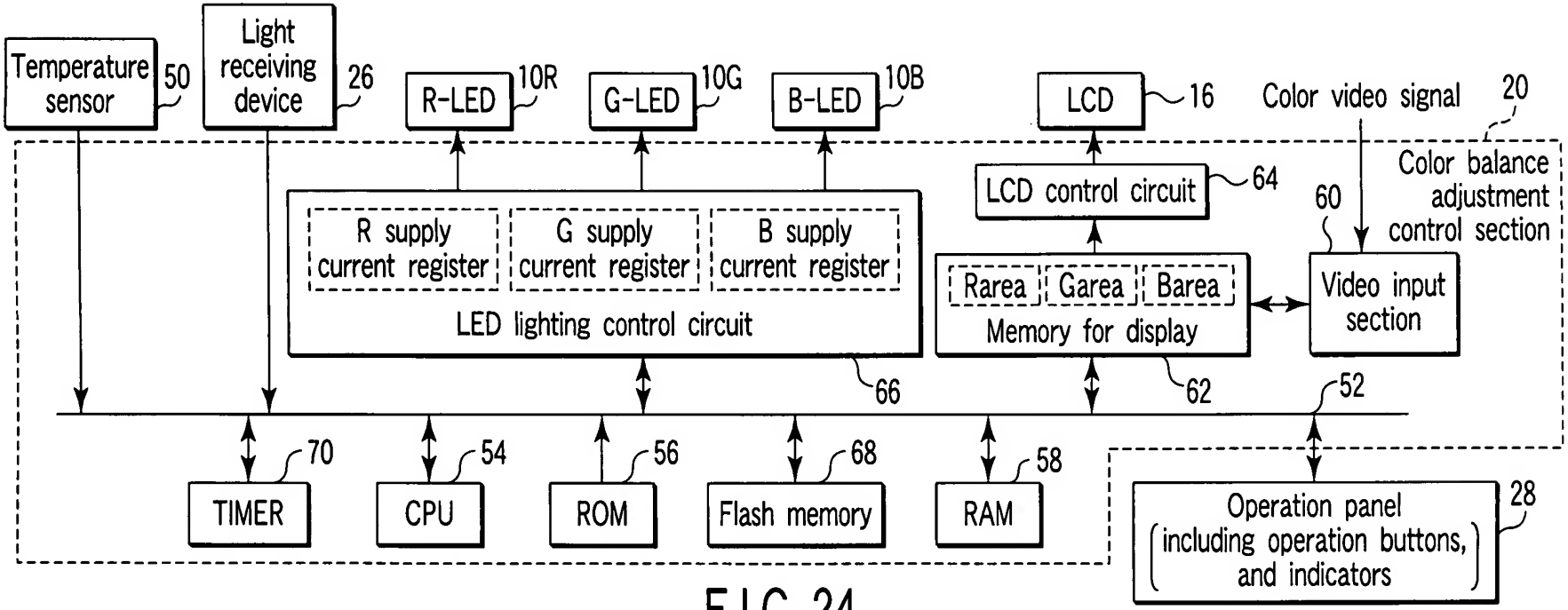

Temperature sensor
50
Light receiving device
26
R-LED
10R
G-LED
10G
B-LED
10B
LCD
16
Color video signal
20
LCD control circuit
64
60
Color balance adjustment control section
R supply current register
G supply current register
B supply current register
LED lighting control circuit
66
Rarea
Garea
Barea
Memory for display
62
Video input section
52
70
54
56
68
58
TIMER
CPU
ROM
Flash memory
RAM
Operation panel (including operation buttons, and indicators)
28

FIG. 24

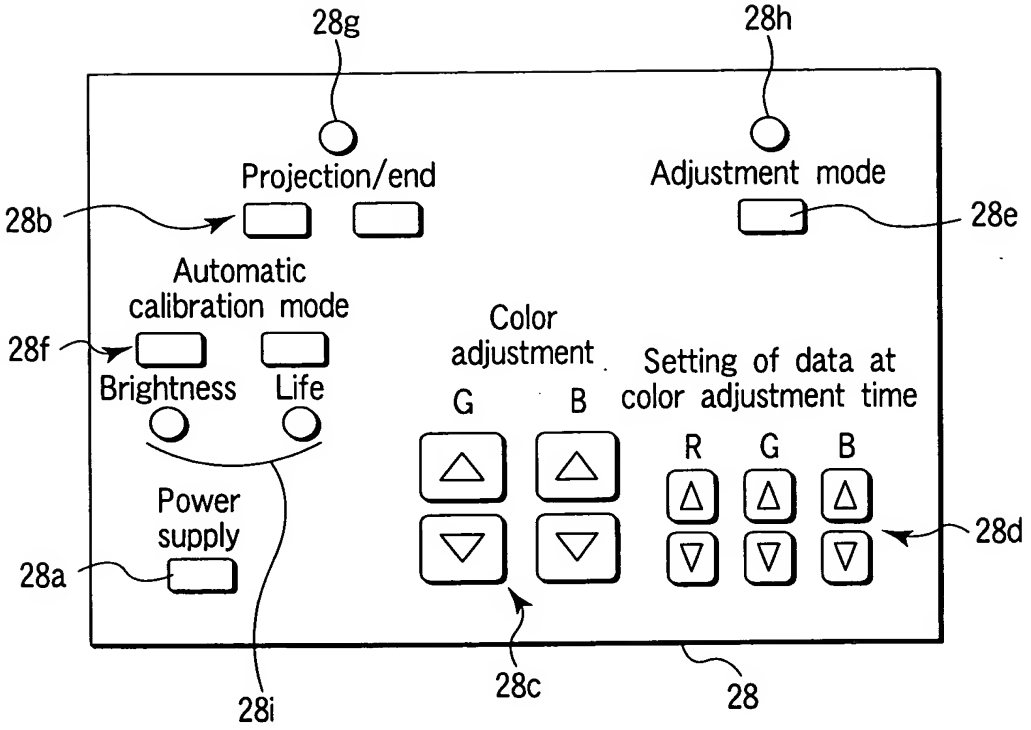

28g
28h
Projection/end
Adjustment mode
28b
28e
Automatic
calibration mode
28f
Brightness
Life
Color
adjustment
G
B
Setting of data at
color adjustment time
R
G
B
Power
supply
28a
28d
28i
28c
28

FIG. 25

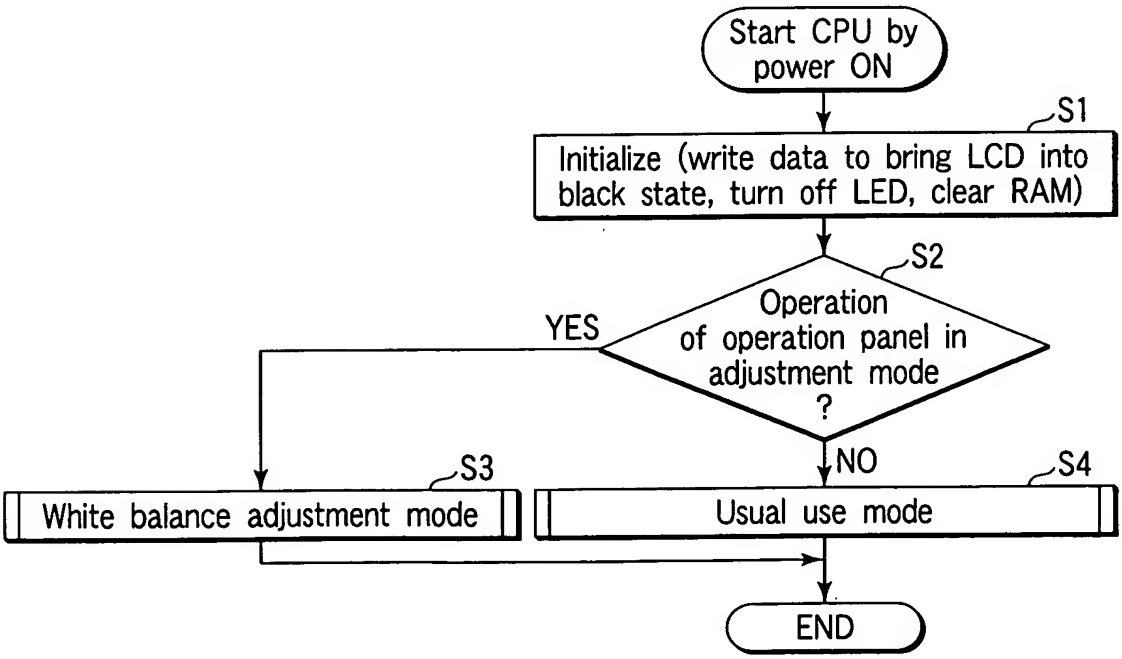

Start CPU by
power ON
S1
Initialize (write data to bring LCD into
black state, turn off LED, clear RAM)
S2
Operation
of operation panel in
adjustment mode
?
YES
NO
S3
White balance adjustment mode
S4
Usual use mode
END

FIG. 26

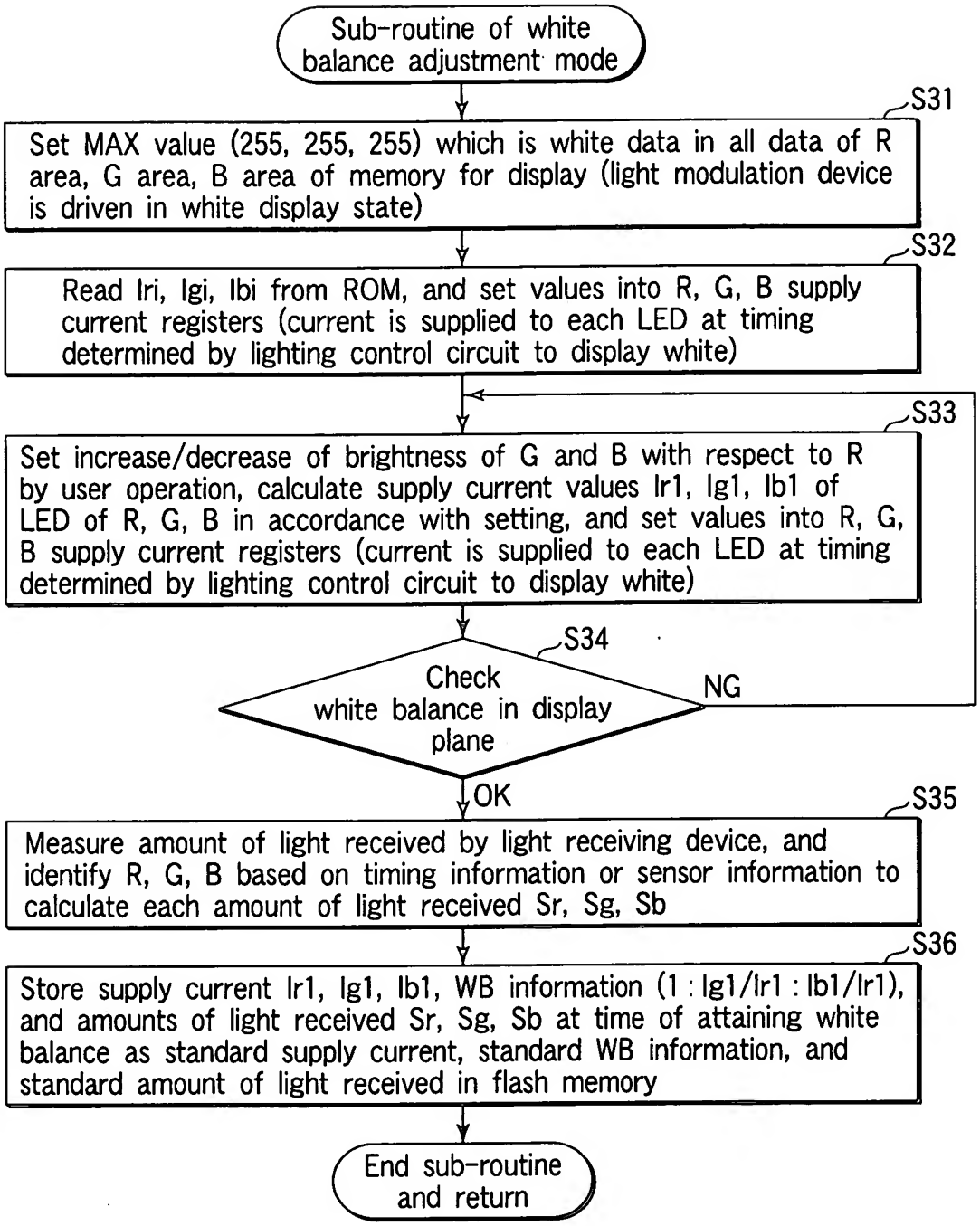

Sub-routine of white balance adjustment mode
S31
Set MAX value (255, 255, 255) which is white data in all data of R area, G area, B area of memory for display (light modulation device is driven in white display state)
S32
Read Iri, Igi, Ibi from ROM, and set values into R, G, B supply current registers (current is supplied to each LED at timing determined by lighting control circuit to display white)
S33
Set increase/decrease of brightness of G and B with respect to R by user operation, calculate supply current values Ir1, Ig1, Ib1 of LED of R, G, B in accordance with setting, and set values into R, G, B supply current registers (current is supplied to each LED at timing determined by lighting control circuit to display white)
S34
Check white balance in display plane
NG
OK
S35
Measure amount of light received by light receiving device, and identify R, G, B based on timing information or sensor information to calculate each amount of light received Sr, Sg, Sb
S36
Store supply current Ir1, Ig1, Ib1, WB information (1 : Ig1/Ir1 : Ib1/Ir1), and amounts of light received Sr, Sg, Sb at time of attaining white balance as standard supply current, standard WB information, and standard amount of light received in flash memory
End sub-routine and return

FIG. 27

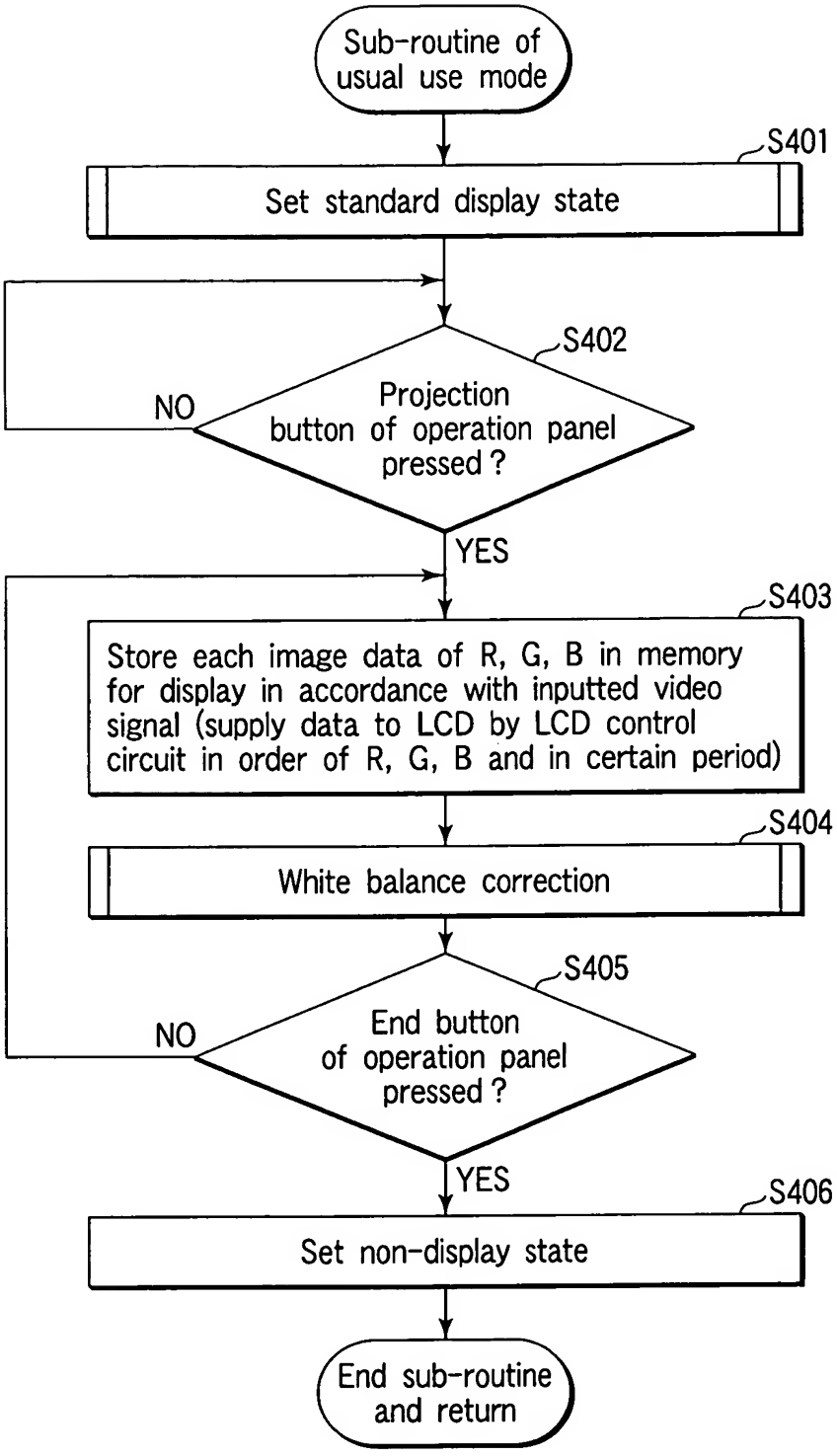

Sub-routine of usual use mode
S401
Set standard display state
S402
Projection button of operation panel pressed ?
NO
YES
S403
Store each image data of R, G, B in memory for display in accordance with inputted video signal (supply data to LCD by LCD control circuit in order of R, G, B and in certain period)
S404
White balance correction
S405
End button of operation panel pressed ?
NO
YES
S406
Set non-display state
End sub-routine and return

FIG. 28

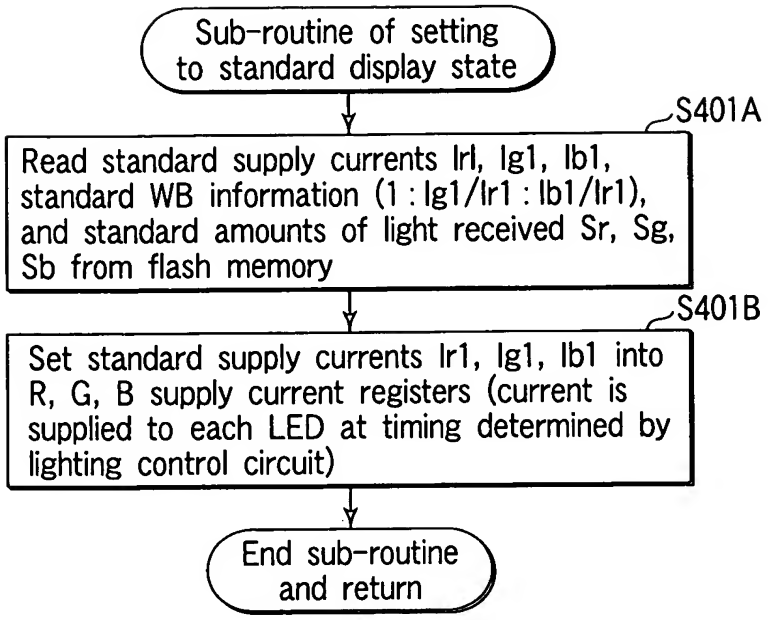

Sub-routine of setting to standard display state
S401A
Read standard supply currents Irl, Ig1, Ib1, standard WB information (1 : Ig1/Ir1 : Ib1/Ir1), and standard amounts of light received Sr, Sg, Sb from flash memory
S401B
Set standard supply currents Ir1, Ig1, Ib1 into R, G, B supply current registers (current is supplied to each LED at timing determined by lighting control circuit)
End sub-routine and return

FIG. 29

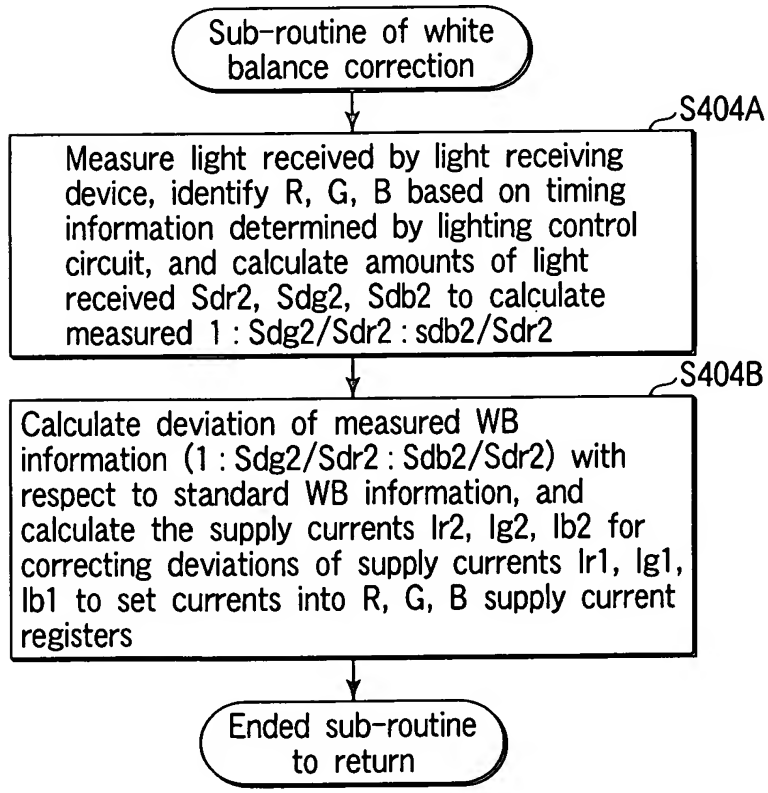

Sub-routine of white balance correction
S404A
Measure light received by light receiving device, identify R, G, B based on timing information determined by lighting control circuit, and calculate amounts of light received Sdr2, Sdg2, Sdb2 to calculate measured 1 : Sdg2/Sdr2 : sdb2/Sdr2
S404B
Calculate deviation of measured WB information (1 : Sdg2/Sdr2 : Sdb2/Sdr2) with respect to standard WB information, and calculate the supply currents Ir2, Ig2, Ib2 for correcting deviations of supply currents Ir1, Ig1, Ib1 to set currents into R, G, B supply current registers
Ended sub-routine to return

FIG. 30

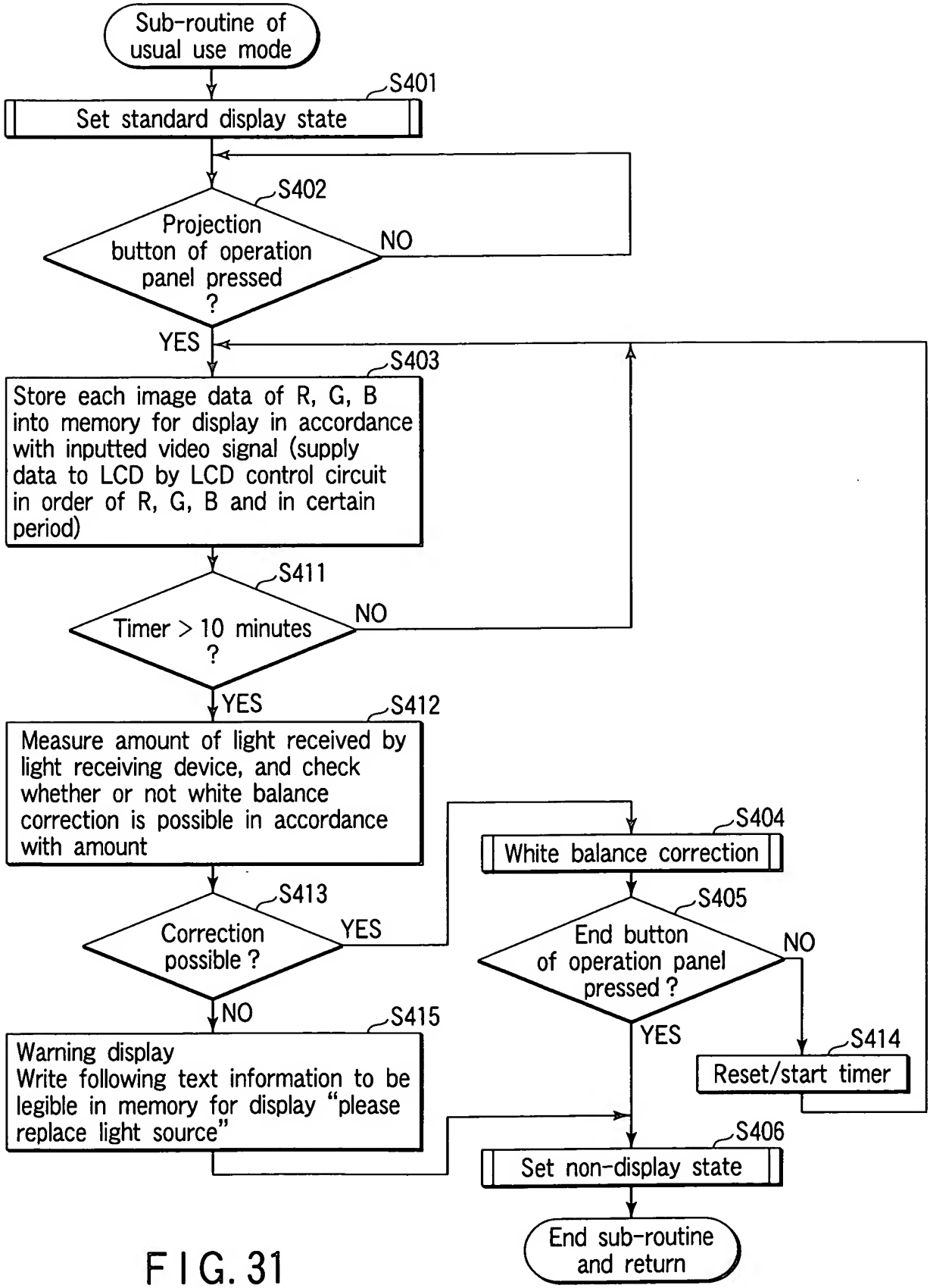

Sub-routine of usual use mode
S401
Set standard display state
S402
Projection button of operation panel pressed ?
NO
YES
S403
Store each image data of R, G, B into memory for display in accordance with inputted video signal (supply data to LCD by LCD control circuit in order of R, G, B and in certain period)
S411
Timer > 10 minutes ?
NO
YES
S412
Measure amount of light received by light receiving device, and check whether or not white balance correction is possible in accordance with amount
S413
Correction possible ?
YES
NO
S415
Warning display
Write following text information to be legible in memory for display "please replace light source"
S404
White balance correction
S405
End button of operation panel pressed ?
NO
YES
S414
Reset/start timer
S406
Set non-display state
End sub-routine and return

FIG. 31

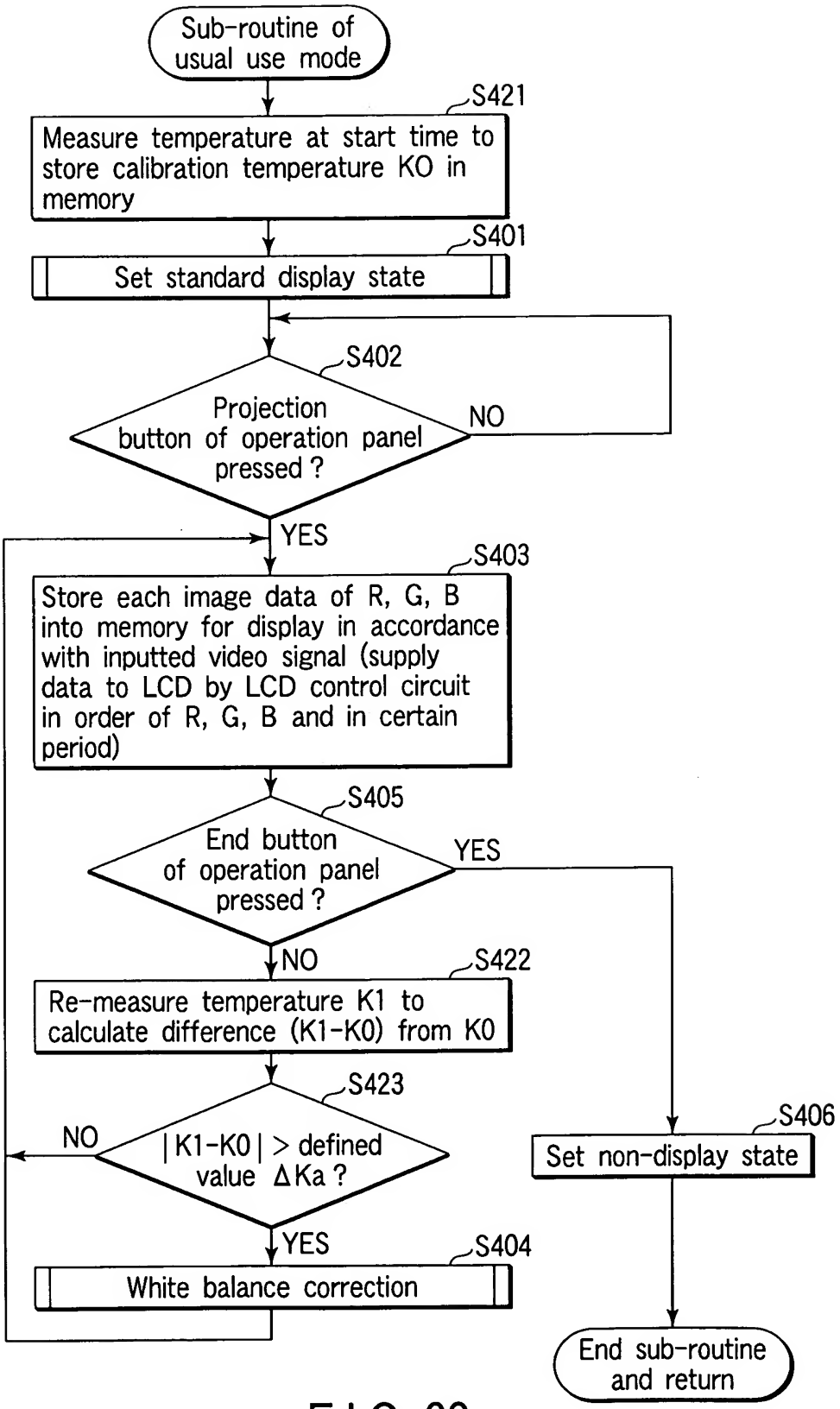

Sub-routine of usual use mode
S421
Measure temperature at start time to store calibration temperature KO in memory
S401
Set standard display state
S402
Projection button of operation panel pressed ?
NO
YES
S403
Store each image data of R, G, B into memory for display in accordance with inputted video signal (supply data to LCD by LCD control circuit in order of R, G, B and in certain period)
S405
End button of operation panel pressed ?
YES
NO
S422
Re-measure temperature K1 to calculate difference (K1-K0) from K0
S423
| K1-K0 | > defined value ΔKa ?
NO
YES
S404
White balance correction
S406
Set non-display state
End sub-routine and return

FIG. 32

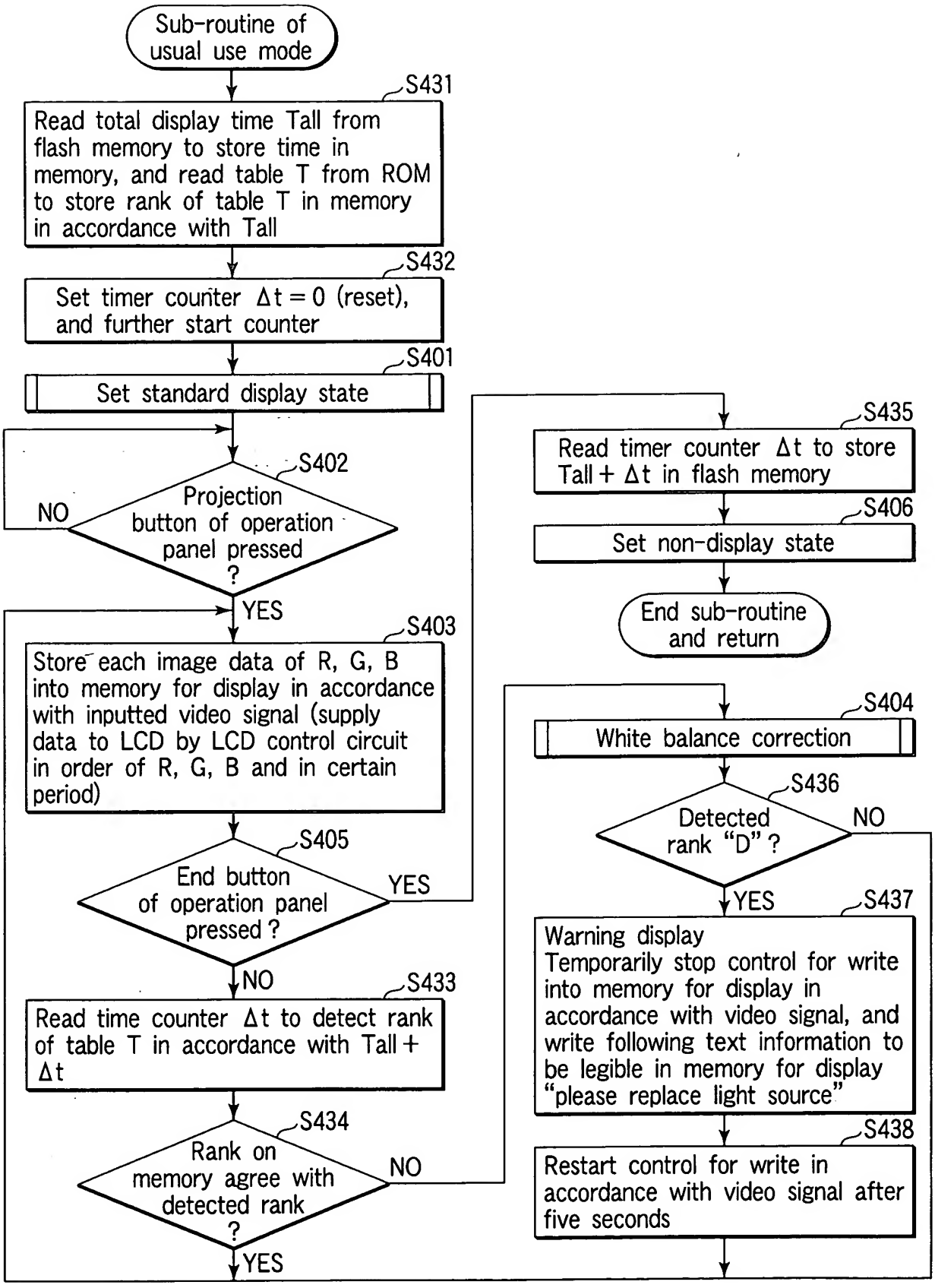

Sub-routine of usual use mode
S431
Read total display time Tall from flash memory to store time in memory, and read table T from ROM to store rank of table T in memory in accordance with Tall
S432
Set timer counter Δt = 0 (reset), and further start counter
S401
Set standard display state
S402
Projection button of operation panel pressed ?
NO
YES
S403
Store each image data of R, G, B into memory for display in accordance with inputted video signal (supply data to LCD by LCD control circuit in order of R, G, B and in certain period)
S405
End button of operation panel pressed ?
YES
NO
S433
Read time counter Δt to detect rank of table T in accordance with Tall + Δt
S434
Rank on memory agree with detected rank ?
NO
YES
S435
Read timer counter Δt to store Tall + Δt in flash memory
S406
Set non-display state
End sub-routine and return
S404
White balance correction
S436
Detected rank "D" ?
NO
YES
S437
Warning display
Temporarily stop control for write into memory for display in accordance with video signal, and write following text information to be legible in memory for display
"please replace light source"
S438
Restart control for write in accordance with video signal after five seconds

FIG. 33

Rank	Tall + Δt
A	5000 hours
B	20000 hours
C	50000 hours
D	100000 hours

FIG. 34

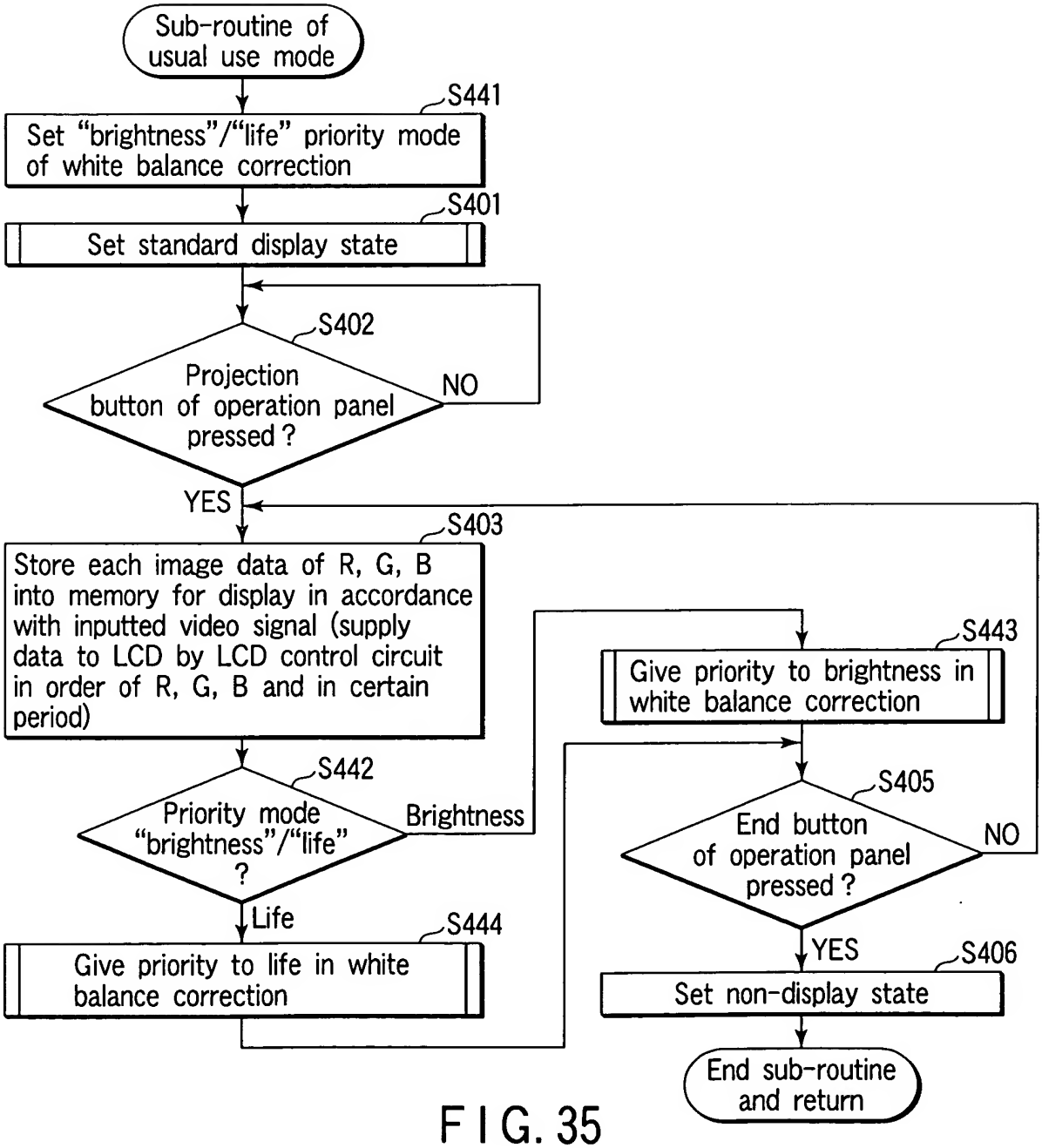


FIG. 35

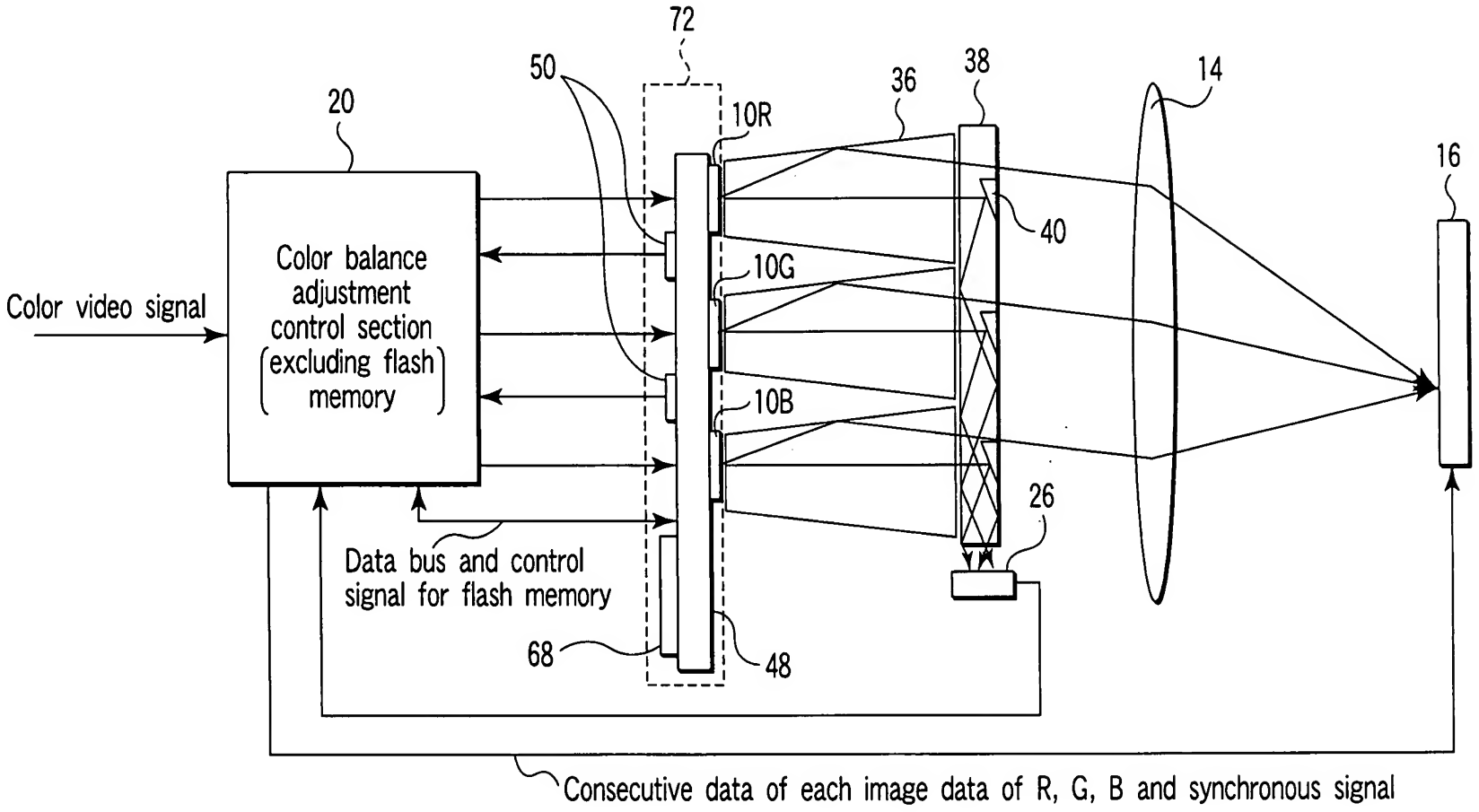

72
50
20
10R
36
38
14
16
40
Color balance adjustment control section (excluding flash memory)
Color video signal
10G
10B
26
Data bus and control signal for flash memory
68
48
Consecutive data of each image data of R, G, B and synchronous signal

FIG. 36

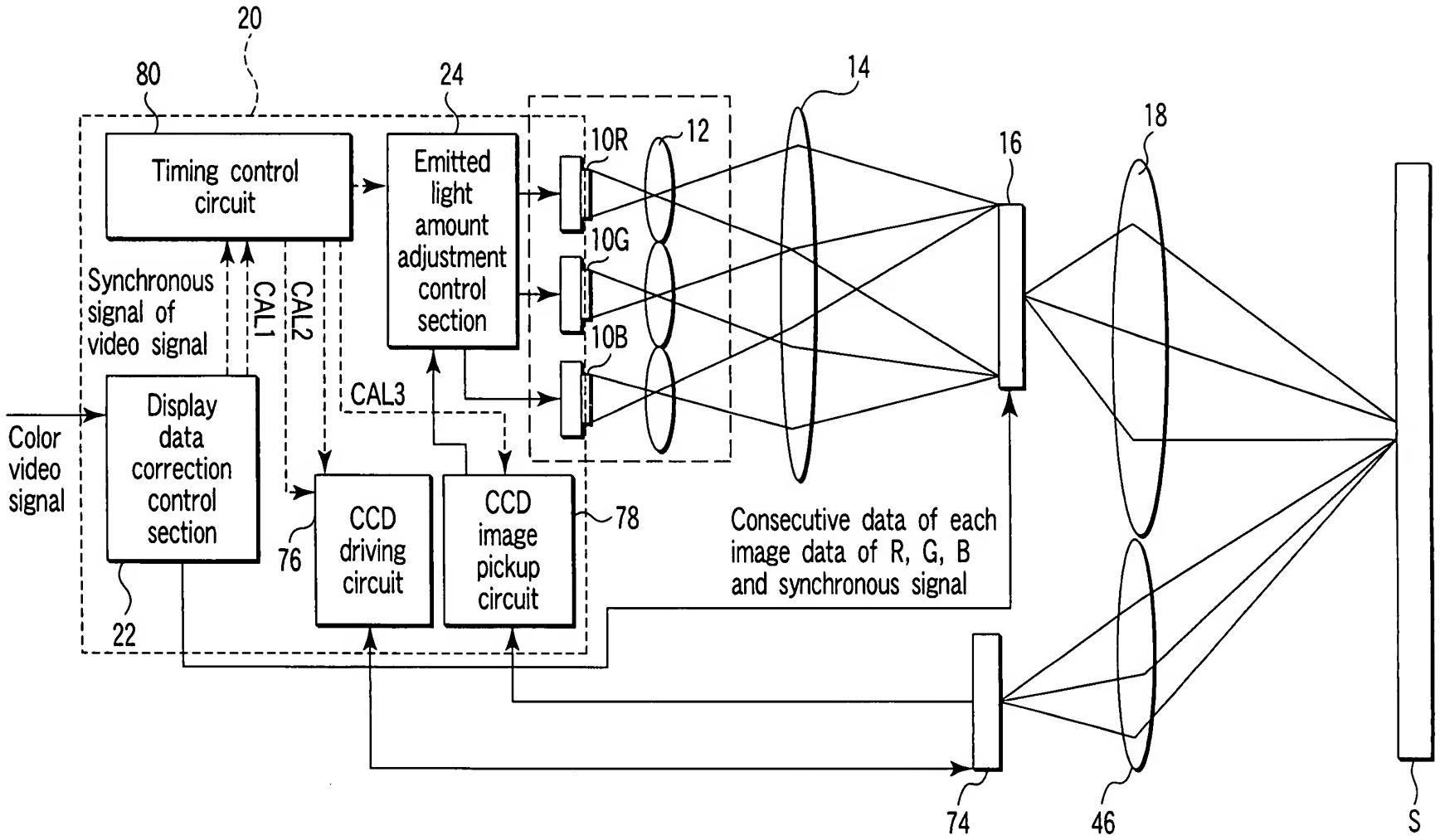

20
80
24
14
18
16
12
10R
10G
10B
Timing control circuit
Emitted light amount adjustment control section
Synchronous signal of video signal
CAL1
CAL2
CAL3
Color video signal
Display data correction control section
22
76
CCD driving circuit
CCD image pickup circuit
78
Consecutive data of each image data of R, G, B and synchronous signal
74
46
S

FIG. 37

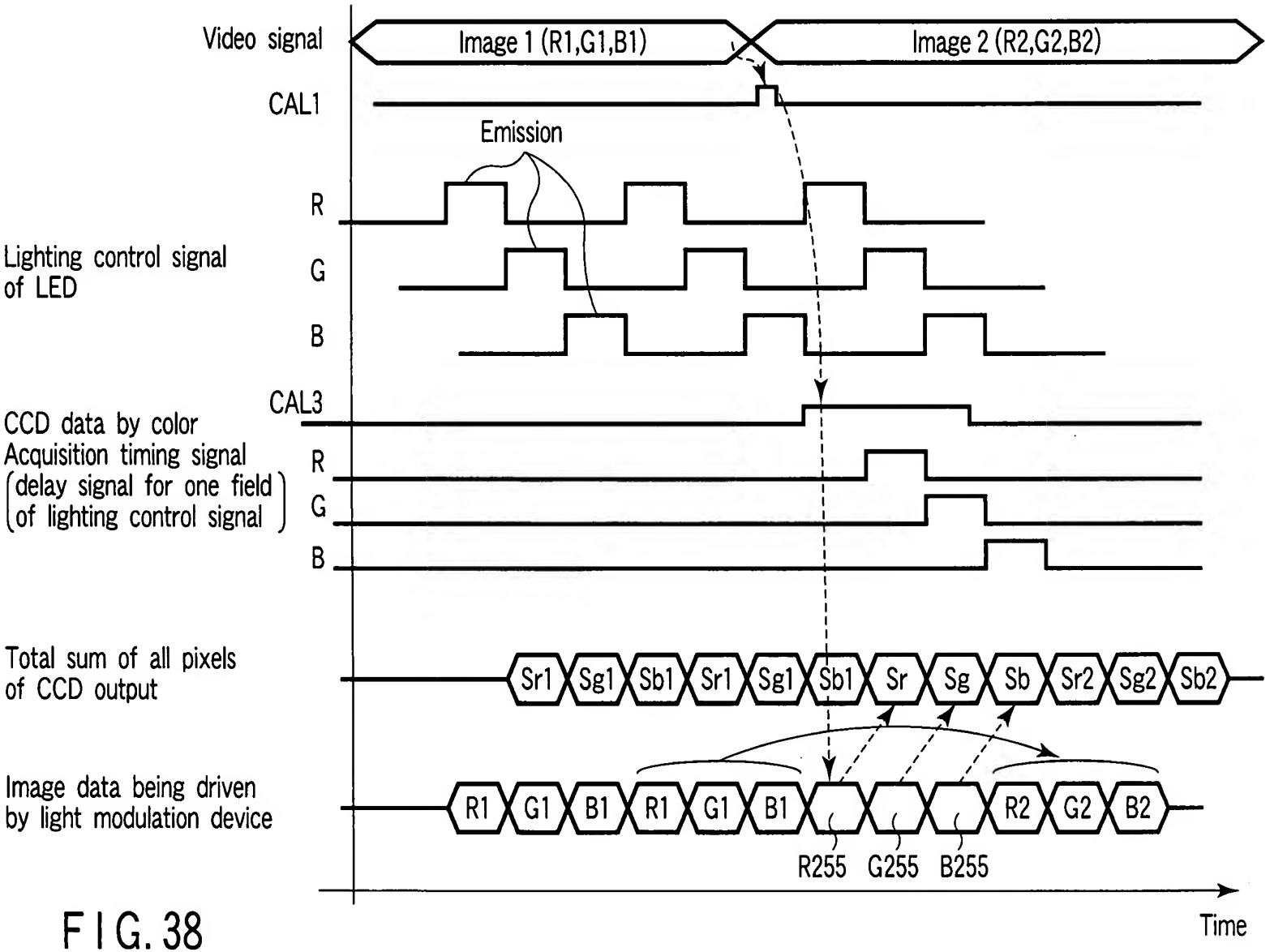

Video signal
Image 1 (R1,G1,B1)
Image 2 (R2,G2,B2)
CAL1
Emission
R
G
B
Lighting control signal of LED
CAL3
CCD data by color Acquisition timing signal (delay signal for one field of lighting control signal)
R
G
B
Total sum of all pixels of CCD output
Sr1 Sg1 Sb1 Sr1 Sg1 Sb1 Sr Sg Sb Sr2 Sg2 Sb2
Image data being driven by light modulation device
R1 G1 B1 R1 G1 B1 R2 G2 B2
R255 G255 B255
Time

FIG. 38

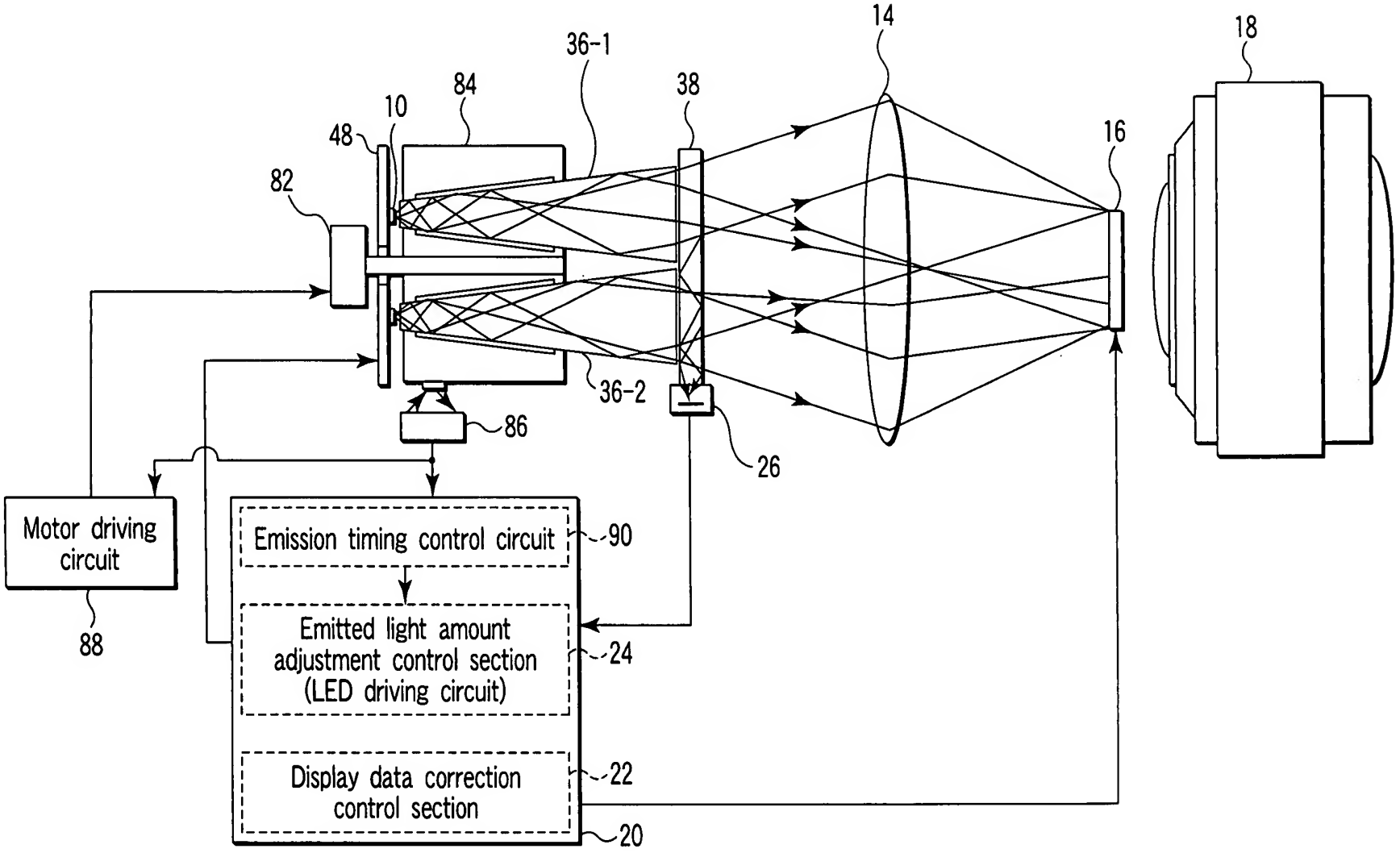

14
18
36-1
84
38
10
48
16
82
36-2
86
26
Motor driving circuit
88
Emission timing control circuit
90
Emitted light amount adjustment control section (LED driving circuit)
24
Display data correction control section
22
20

FIG. 39

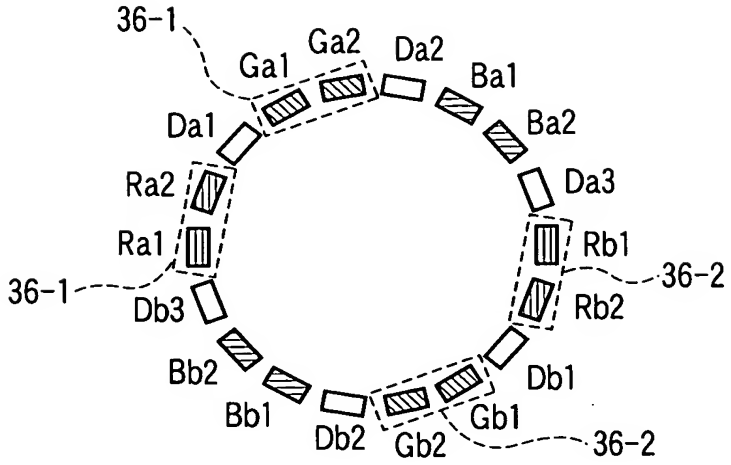

36-1
Ga1
Ga2
Da2
Ba1
Ba2
Da1
Da3
Ra2
Rb1
Ra1
36-2
36-1
Rb2
Db3
Db1
Bb2
Gb1
Bb1
Db2
Gb2
36-2

FIG. 40

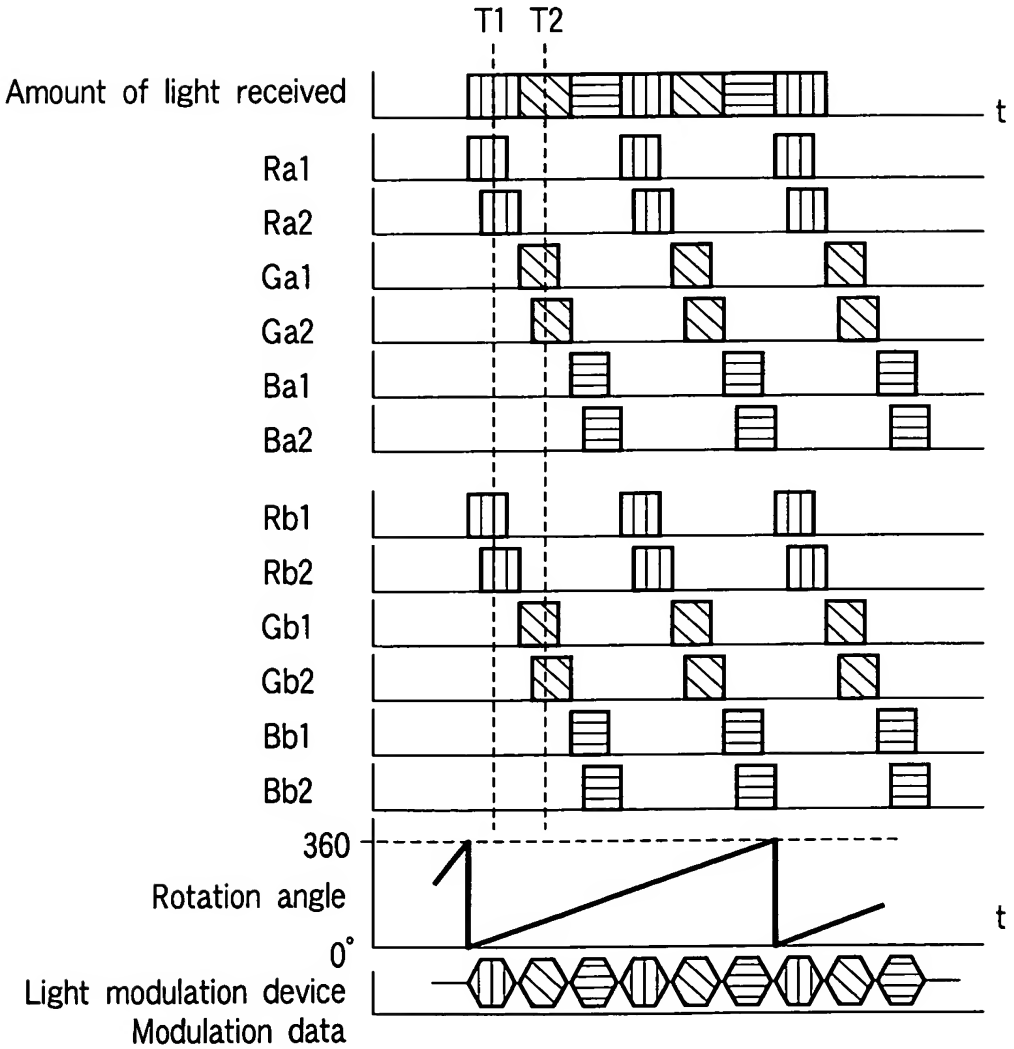

T1
T2
Amount of light received
t
Ra1
Ra2
Ga1
Ga2
Ba1
Ba2
Rb1
Rb2
Gb1
Gb2
Bb1
Bb2
360
Rotation angle
0°
t
Light modulation device
Modulation data

FIG. 41

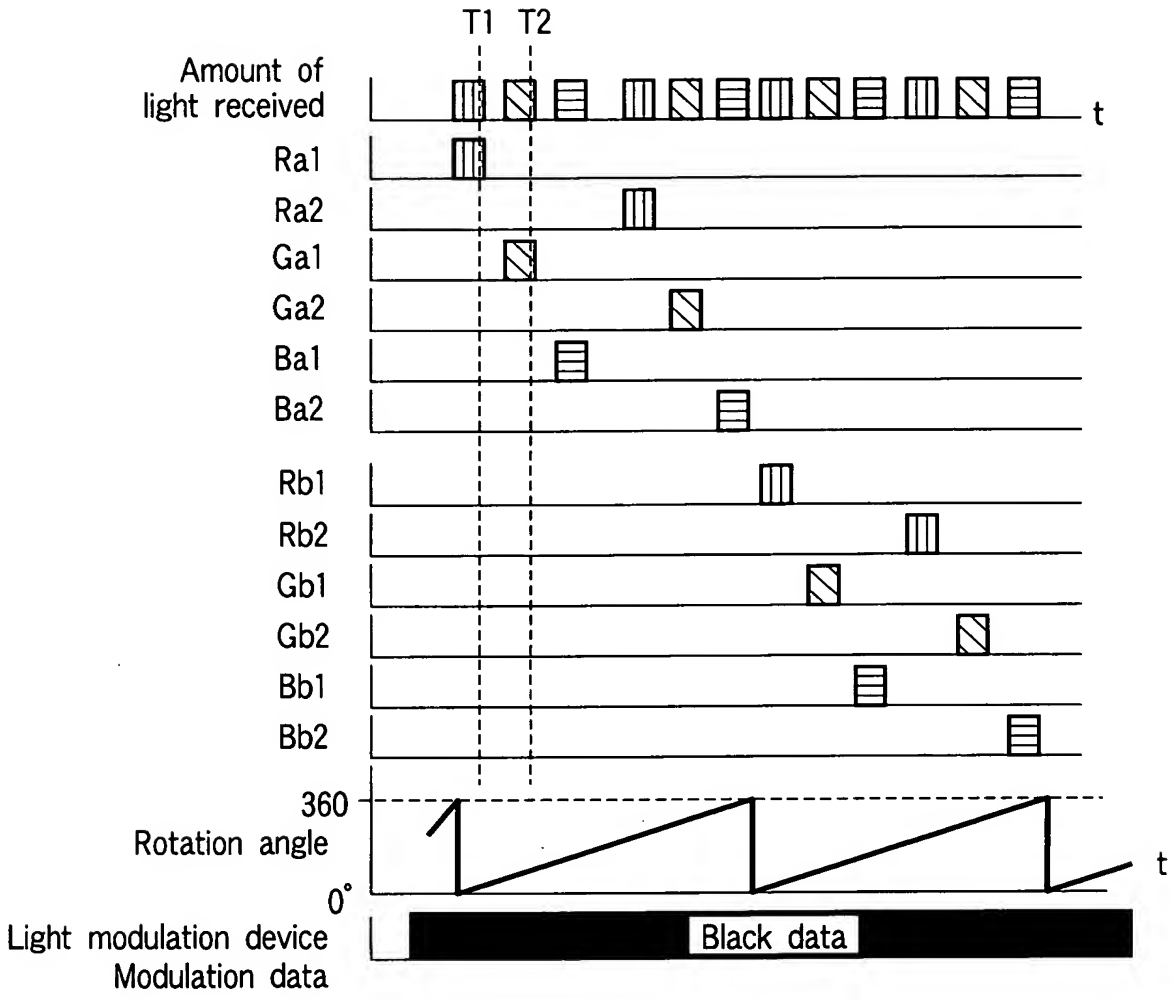

T1
T2
Amount of light received
t
Ra1
Ra2
Ga1
Ga2
Ba1
Ba2
Rb1
Rb2
Gb1
Gb2
Bb1
Bb2
360
Rotation angle
0°
t
Light modulation device Modulation data
Black data

FIG. 42